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Jun 69

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RADIATION FACTORS

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EMISSION FACTORS

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Walter D. Kroetsch

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U. S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Public Health Service
Consumer Protection and Environmental Health Service
National Air Pollution Control Administration

June 1969

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ABSTRACT

A method has been developed for the prediction of gaseous pollutants emitted into the national environment from on-the-road gasoline powered vehicles. The method involved two quantities, the emissions emitted per mile traveled, and the total mileage traveled. Vehicular emissions were characterised by engine type and load under actual operating conditions. Five vehicle types and two use classes were used to define characteristic vehicular emissions. Vehicle types were automobile (auto), light duty truck (LDT), and three weight classes of heavy duty trucks (HDT). The two use classes were urban and rural.

The method allows comparison between the possible degrees of control, methods of control, and implementation dates. The method could be utilised on a regional rather than national basis, and could include particulates as well as gaseous pollutants.

OBJECTIVE

The immediate objective of this study was to obtain a prediction of total national vehicular emissions of nitrogen oxides, hydrocarbon, and carbon monoxide during a calendar year. The method developed allows the evaluation of vehicular emission controls which have been implemented as well as providing a technique to evaluate the relative effectiveness of future controls (such as fuel modification, engine changes, etc.) as represented by changes in emission source and/or amount.

METHOD

The method requires knowledge of: 1) the mean annual road emissions of a characteristic vehicle in mass per distance traveled, and 2) the total distance traveled during the calendar year by that portion of the total vehicular population characterized by the vehicle. Classification of vehicles was by use: urban or rural driving; and by general type: auto, LDT (GVW less than 8,000#), HDT(II) (GVW of 8,000-10,000#), HDT(III) (GVW of 10,000-19,500#), HDT(IV) (GVW over 19,500#). Vehicles in a class were categorized by the model year (the model year is the calendar year the vehicle entered the population). This is basically characterization of vehicular emissions by engine type, load, and age.

TYPE	CLASS	CATEGORY (AXLES)
Auto	Urban	1
		2
		3
	Rural	1
		2
		3
HVT	Urban	1
		2
		3
	Rural	1
		2
		3

etc.

Reference characteristic emissions were obtained for each of the vehicular types and use classifications. Emissions for the categories in a vehicular class, i.e., the vehicle age, were obtained through the development of a mean deterioration factor. The deterioration factor was considered to be solely a function of accumulated road mileage, thus accommodating changes among vehicles in driving usage. It was assumed that vehicular deterioration will not change and that the mileage distribution with age will also remain constant.

The reference characteristic vehicular class emissions were based on an accumulated mileage of 2,000 miles to permit a direct relationship between the road emissions at 2,000 and emissions from vehicles run entirely on the existing Federal dynamometer cycle. The relationships among the various operating conditions are themselves independent of mileage.

Four emission sources were considered: fuel tank evaporation, carburetion evaporation, crankcase blowby, and engine exhaust. The two evaporative emissions were assumed to be independent of vehicular type, use, and age. Crankcase blowby, when applicable, was assumed to deteriorate as exhaust. HDT vehicles were assumed to deteriorate as automobiles, assuming that the increase in mileage traveled is offset by more durable construction.

Three gaseous pollutants were considered, hydrocarbons (based on a hydrogen/carbon ratio of 1.85 to 1.00), carbon monoxide, and nitrogen oxides (as NO_2). Emissions from evaporative sources and crankcase blowby were presumed to consist entirely of hydrocarbons.

Rural driving was characterized by hot start 45 mph (average route speed) operating conditions; urban driving, by cold start 25 mph (average) operating conditions. The choice was based primarily on data from the U. S. Bureau of Highways.

RESULTS

Predicted total emissions of hydrocarbon, carbon monoxide, and oxides of nitrogen for the year 1960 through 1990 are shown with the following assumptions: that the actual emissions for the periods 1963-1967, 1968-1969, 1970, 1971-1974, and 1975-1990 correspond to the following Federal dynamometer cycle emissions.

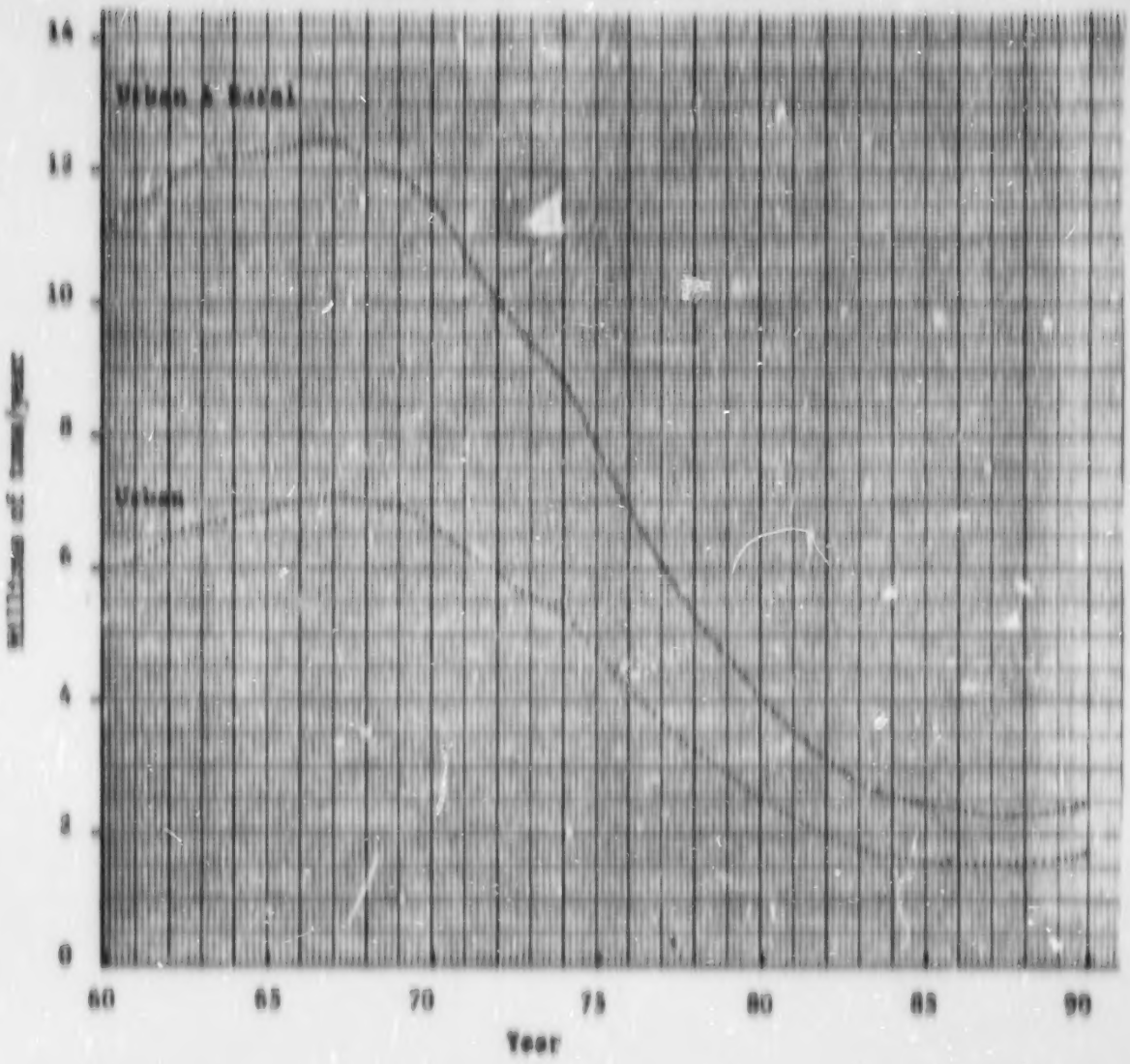
REFERENCE AUTOMOTIVE EMISSIONS

TYPE	VALUE	1962	1963-1967	1968-1969	1970	1971-1974	1975-1990
NO_x - Exhaust	gm/mile	5.757	5.757	5.757	5.757	5.757	0.960
	ppm	1500	1500	1500	1500	1500	250
CO - Exhaust	gm/mile	87.234	87.234	35.103	23.000	23.000	11.500
	%	3.7	3.7	1.5	1.0	1.0	0.5
HC - Exhaust	gm/mile	5.678	5.678	3.428	2.200	2.200	0.611
	ppm	456	456	275	176	176	49
HC - Evaporative	gm/mile	2.767	2.767	2.767	2.767	0.490	0
HC - Crankcase	gm/mile	3.151	0	0	0	0	0

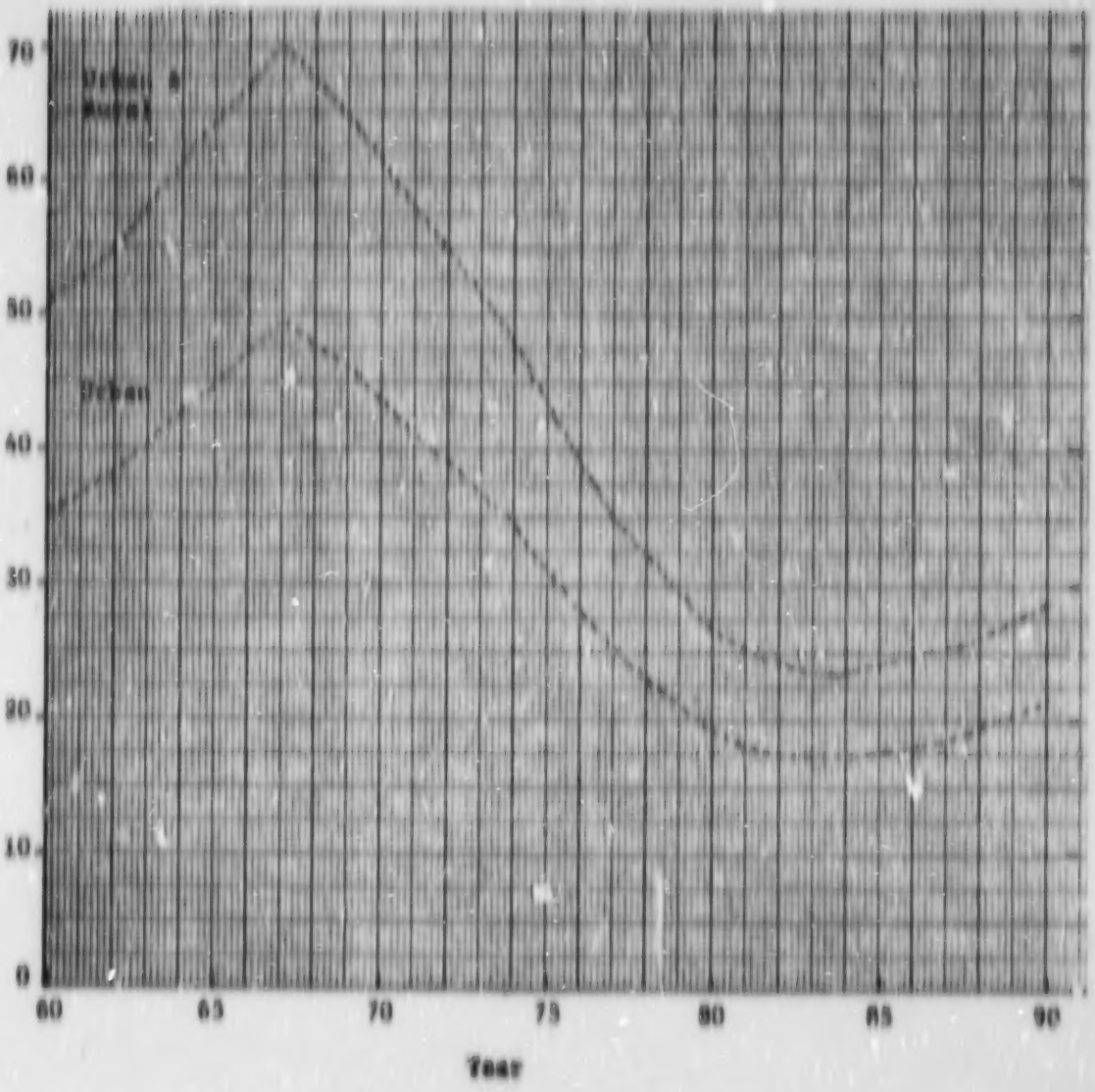
Concentration values are based on exhaust volume of 70.68 standard cubic feet/mile and pollutant densities of 16.33 gm/scf for hydrocarbon, 33.11 gm/scf for carbon monoxide, and 54.30 gm/scf for nitrogen dioxide.

Emissions are for Federal composite cycle.

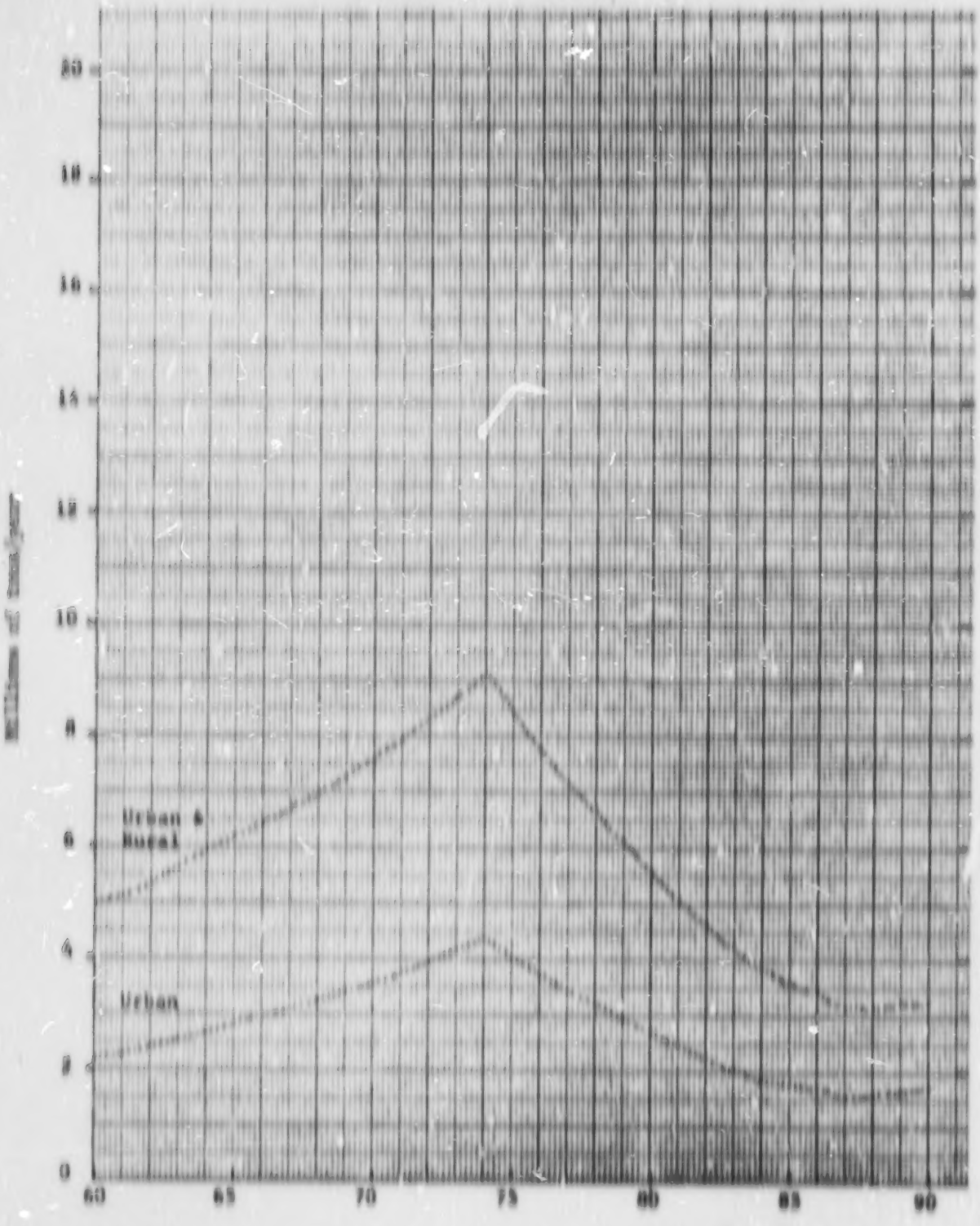
ESTIMATED TOTAL VEHICULAR EMISSIONS OF HYDROCARBONS
(WITH ADDITIONAL CONTROLS IN 1975)



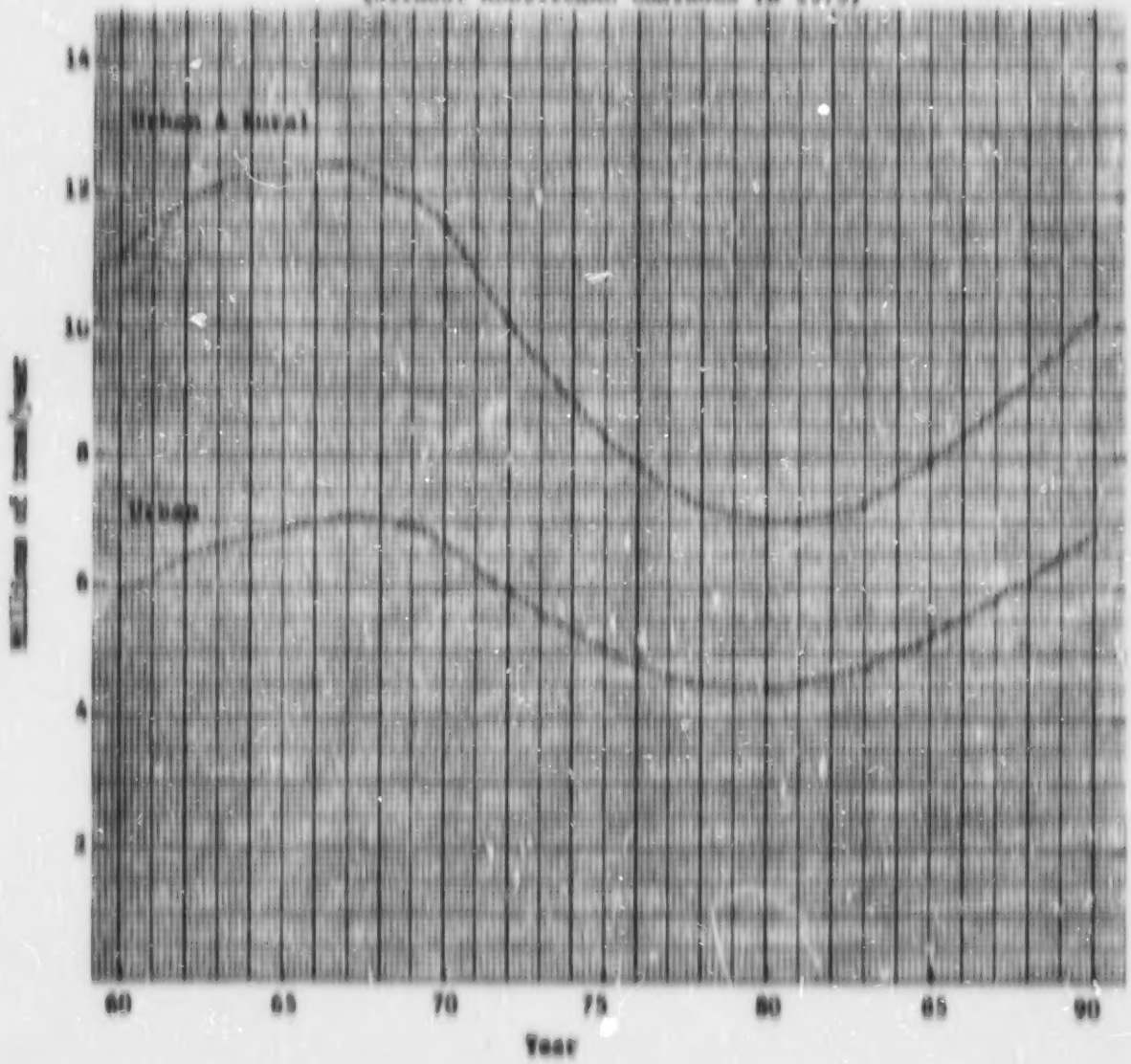
ESTIMATED TOTAL VEHICULAR EMISSIONS OF CARBON MONOXIDE
(WITH ADDITIONAL CONTROLS IN 1975)



ESTIMATED TOTAL VEHICULAR EMISSIONS OF NITROGEN DIOXIDE
(WITH ADDITIONAL CONTROLS IN 1975)



ESTIMATED TOTAL VEHICULAR EMISSIONS OF HYDROCARBONS
(WITHOUT ADDITIONAL CONTROLS IN 1975)



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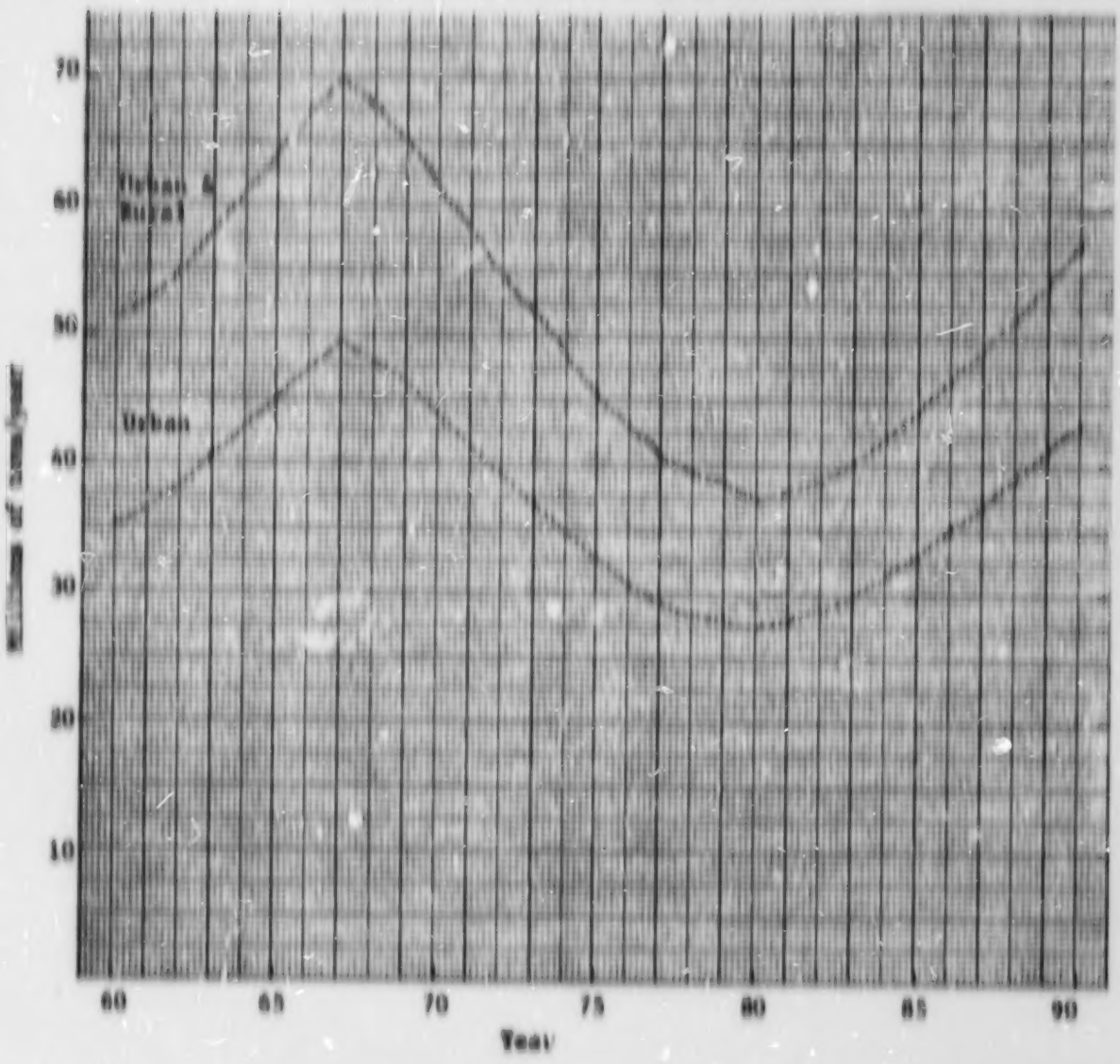
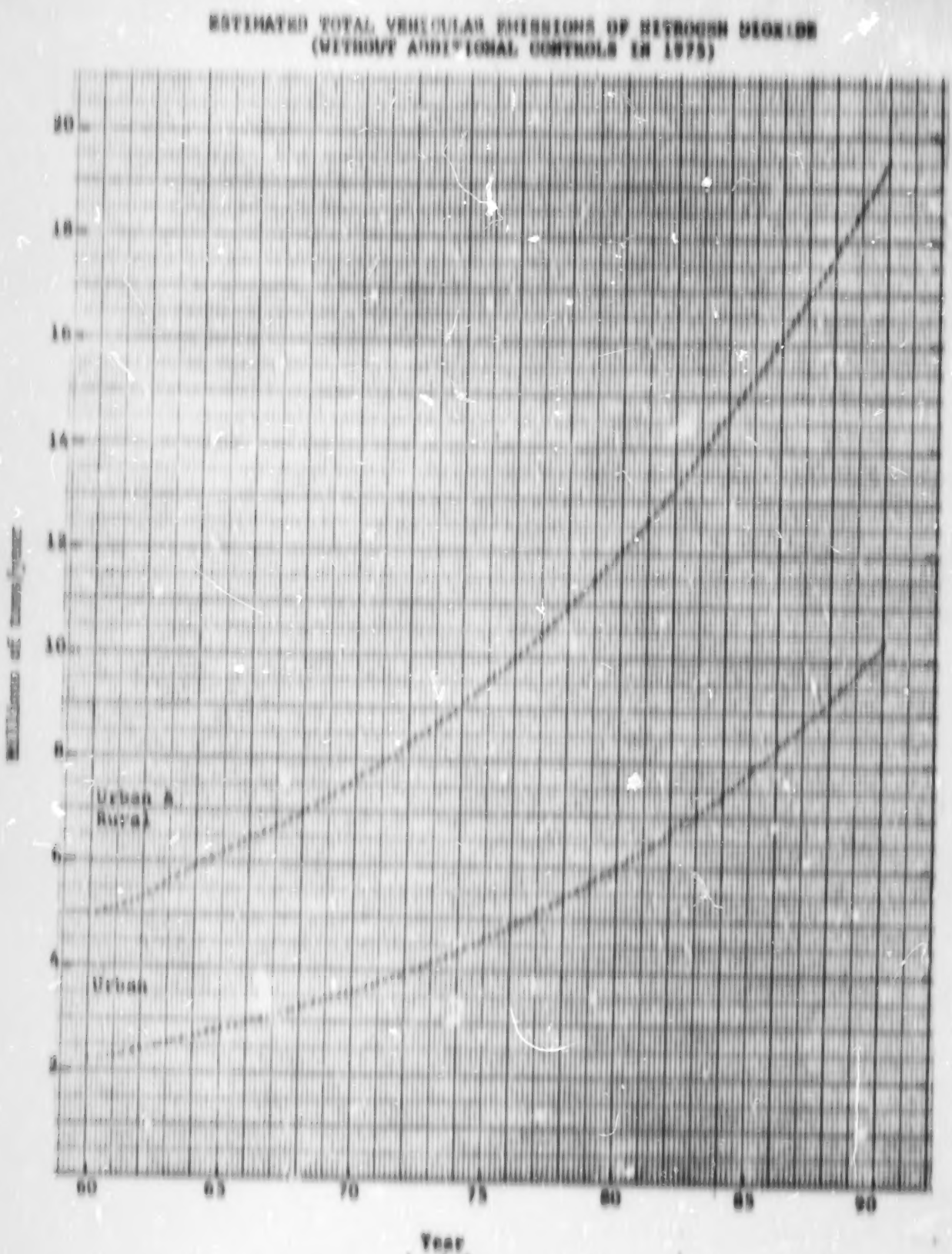
(WITHOUT ADDITIONAL CONTROLS IN 1975)




ESTIMATED TOTAL VEHICULAR EMISSIONS OF NITROGEN DIOXIDE
(WITHOUT ADDITIONAL CONTROLS IN 1975)
20
18
16
14
12
10
8
6
4
2
Urban & Rural
Urban
60
65
70
75
80
85
90
Year

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1. EXHAUST EMISSIONS

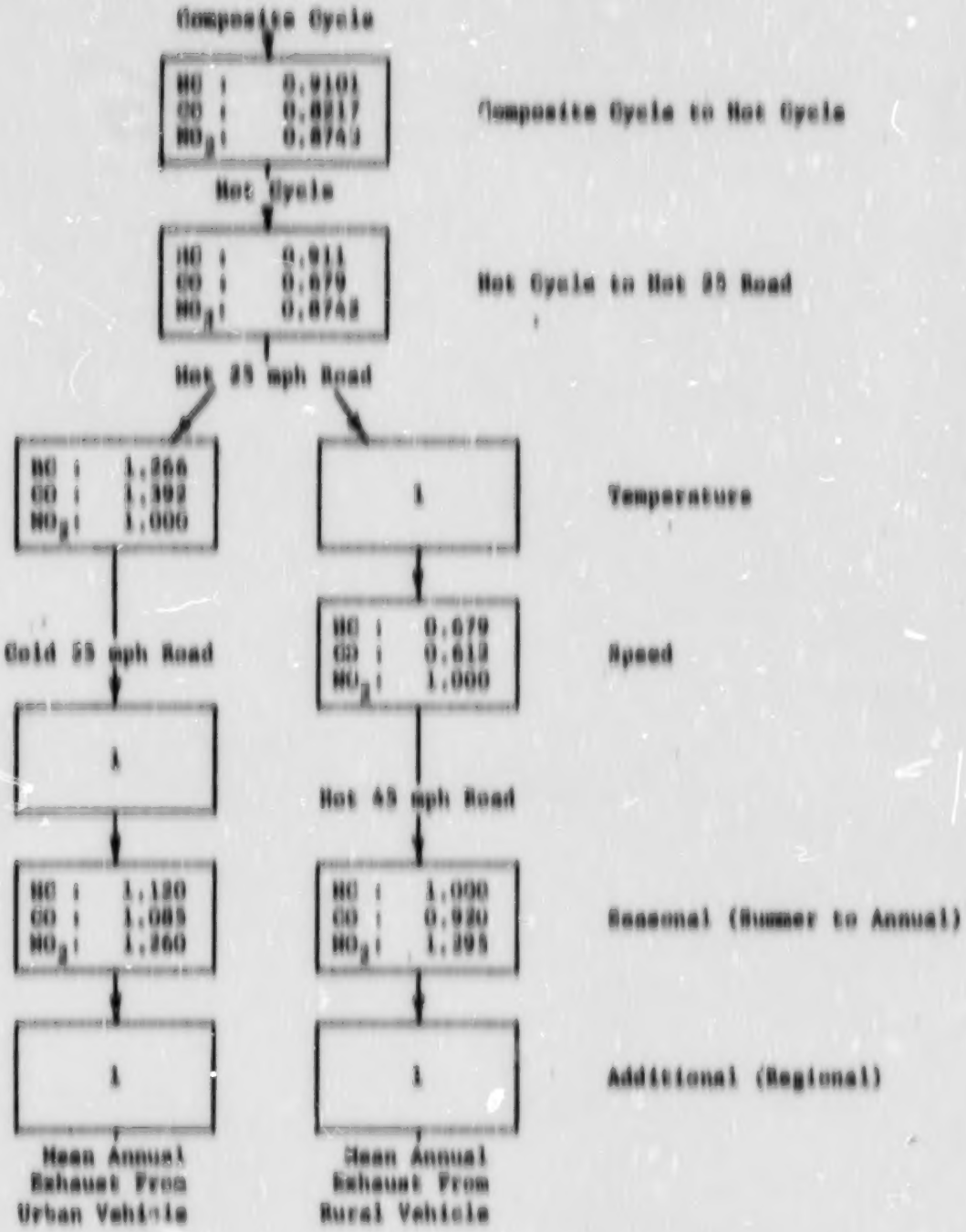
In view of the varied operating conditions from which emission values could be obtained (or specified), the first concern was the development of relations between emissions from different operating conditions. The objective was a reference mean annual emission for each class type and use of vehicle.

Operating conditions were assumed to have no effect upon either evaporative emissions or crankcase blowby emissions.

The amount of exhaust emissions from a vehicle very definitely depends upon the operating conditions. It was assumed that the relationships between operating conditions are mutually independent ratios and that they are independent of exhaust composition and amount, mileage accumulation, engine size, control devices, engine modifications, fuel changes, and/or vehicle type.

Characterization of urban and rural driving was by average route speed and trip duration (average engine temperature). Urban trip operating conditions were taken as 25 mph cold start; rural trip, as 45 mph hot start. These operating conditions were chosen based on data from the U. S. Bureau of Highways, the Los Angeles Regional Traffic Survey of 1960, and the City of Cincinnati Department of Public Utilities.

4.1 EXHAUST EMISSION FLOW DIAGRAM



1.9 Conversion Composite Cycle to Hot Cycle (Charles E. Zimmer)

Emission values of composite cycle and hot cycle tests were available for 1134 cases from surveillance and certification testing by the Division of Motor Vehicle Pollution Control. Means and 95% confidence levels for the ratio of hot cycle to composite cycle were obtained from Charles E. Zimmer, Chief, Management Systems Branch.

All autos had control devices. There were no separations by transmission type, mileage, control device, or model year.

Supporting papers are attached as follows: 1) memo to A. H. Rose, Jr. from Charles E. Zimmer, dated January 23, 1969; and 2) memo to W. D. Kroetch from Charles E. Zimmer, dated February 18, 1969.

Memorandum

PUBLIC HEALTH SERVICE
CONSUMER PROTECTION AND ENVIRONMENTAL HEALTH SERVICE
National Air Pollution Control Administration
411 West Chapel Hill Street
Durham, North Carolina 27701

TO : Andrew Rose

DATE: January 23, 1969

FROM : Chief, Management Systems Branch

SUBJECT : Statistical Results of Motor Vehicle Data

The comparison of the ratios of Hot Cycle values to the composite values produced the following results:

	Mean	Standard Deviation	Confidence Interval
HC	.9101	.0497	.9061 - .9129
CO	.8217	.1705	.8119 - .8315
CO_2	1.0144	.0144	1.0136-1.0152

The above values were computed from 1154 ratios for each pollutant.

Charles E. Wimmer

HELP ELIMINATE WASTE HEW COST REDUCTION PROGRAM

Memorandum

PUBLIC HEALTH SERVICE
CONSUMER PROTECTION AND ENVIRONMENTAL HEALTH SERVICE
National Air Pollution Control Administration
411 West Chapel Hill Street
Durham, North Carolina 27701

DATE: February 18, 1969

TO : Walter Krotsch, Cincinnati, Ohio

FROM : Chief, Management Systems Branch

SUBJECT : Ratio of Hot Cycle to Composite Emissions from Motor Vehicles

The values for each pollutant reported to you represent the mean, standard deviation, and 95% confidence interval for the ratio of the Hot Cycle value to its composite value. The results were obtained by calculating the ratio of 1154 observations for each pollutant. Their data resulted from both certification and surveillance testing at the Ypsilanti laboratory. The sum of the ratios divided by the observations gives the mean value reported.

The formula used to calculate the standard deviation was:

$$S = \left[\frac{N\sum x^2 - (\sum x)^2}{N(N-1)}\right]^{\frac{1}{2}}$$ where:

N = the number of observations = 1154
x = the ratio of Hot Cycle to composite emissions
S = standard deviation.

The confidence limit formula used was:

$$C = \bar{x} \pm 1.96 \left(\frac{S}{\sqrt{n}}\right)$$ where:

C = confidence limit
$\bar{x}$ = mean
1.96 = factor for 95% confidence
S = standard deviation
N = number of observations = 1154.

Charles E. Zimmer

HELP ELIMINATE WASTE — HEW — COST REDUCTION PROGRAM

1.3 Conversion Hot Cycle to Hot 25 mph Road (Gerald O. Ahland)

Ratios of hot road to hot cycle were determined from three series of Cincinnati CSA tests. The tests in each series were consecutive dynamometer and road emission tests run in duplicate. The vehicles were run on a dynamometer load of 3,500 lbs. Sixty vehicles were used, ten uncontrolled and ten controlled from three makes, General Motors, Ford, and Chrysler. All vehicles were equipped with automatic transmissions. Mileage accumulation was by normal driving.

The ratios were determined for each vehicle and test in the three series. Although the magnitude of the emission levels changed with mileage accumulation, no statistical difference in the ratios was observed based on control/ noncontrol, mileage, or manufacturer.

SUMMARY STATISTICAL ANALYSIS OF EXHAUST RATIO OPERATING CONDITIONS

HOT ROAD / HOT CYCLE

BY SERIES, COMBINED MANUFACTURERS

	WITH CONTROL			WITHOUT CONTROL			COMBINED		
HC	#1	#2	#3	#1	#2	#3	#1	#2	#3
95% Confidence Limit	1.2139	1.1732	1.0059	1.2560	1.2242	1.1579	1.2367	1.2029	1.0832
Mean	0.9586	0.8859	1.0044	0.9761	0.8378	0.8536	0.9434	0.8618	0.9290
95% Confidence Limit	0.7032	0.5986	0.1029	0.5964	0.4514	0.5493	0.648[illegible]	0.5208	0.8448
CO	#1	#2	#3	#1	#2	#3	#1	#2	#3
95% Confidence Limit	0.9446	0.8539	0.8696	1.1403	0.9[illegible]34	0.9867	1.07[illegible]	0.9189	0.9485
Mean	0.6739	0.5952	0.6002	0.8080	3.9[illegible]29	0.7121	0.7402	0.6390	0.6561
95% Confidence Limit	0.4032	0.3364	0.3309	0.4755	0.4063	0.4374	0.4113	0.3593	0.3638

BY MANUFACTURER, COMBINED SERIES

	95% Conf. Limit	HC Mean	95% Conf. Limit	95% Conf. Limit	CO Mean	95% Conf. Limit
Chevrolet - With Control	0.6162	0.8706	1.1250	0.4098	0.6518	0.8938
Chevrolet - No Control	0.5031	0.8265	1.1498	0.5759	0.7979	1.0199
Ford - With Control	0.5192	0.9882	1.4571	0.3806	0.5974	0.8142
Ford - No Control	0.7543	1.0199	1.2856	0.5470	0.8108	1.0745
Plymouth - With Control	0.1737	0.9900	1.8064	0.2779	0.6201	0.9622
Plymouth - No Control	0.5415	0.7712	1.0010	0.3555	0.5942	0.8329
All Makes - With Control	0.3817	0.9496	1.5176	0.1500	0.6231	0.8962
All Makes - No Control	0.4957	0.8725	1.2193	0.4227	0.7363	1.0459
Composite	0.4355	0.9111	1.3866	0.3660	0.6787	0.9914

Note: Series designates accumulated road mileage on random sample of USA vehicles. Mileage accumulation was not uniform, odometer readings ranged from 1 000 to 23,000 miles.

1.4 Conversion Hot 35 mph Road to Cold 35 mph Road

Data were extracted from three sources: 1) "A Comparison of Automotive Emissions in Cities at Low and High Altitudes" - using data from Cincinnati and Los Angeles; 2) "Automotive Emissions after Hot and Cold Starts in Summer and Winter" - recomputed from the raw data to insure that data used in the evaluation were for ambient temperatures over 50° F; and 3) "Cincinnati CBA Data."

From References 1 and 2, automotive population was a random sample with no distinction among transmission types or mileage. All automobiles were uncontrolled with a mean age of five years.

For Source (3), all automobiles had automatic transmissions with half of the sample population having control devices.

SEPARATION DATA BY AMBIENT TEMPERATURE FROM "AUTOMOTIVE EMISSIONS AFTER HOT AND COLD STARTS IN SUMMER AND WINTER"

	Ambient Conc.	Δ 50° F g/mile	Ambient Conc.	Δ 50° F g/mile	Combined Δ, 70-A Conc.	g/mile
Cold Start						
HC-FIA	6773	0.01911	6165	0.01521	6469	0.1736
CO	3.76	0.21384	3.53	0.1767	3.64	0.1948
NO_x	1199	0.1106	1047	0.01083	1123	0.01083
No. of Tests	26		26		52	
Hot Start						
HC-FIA	5469	0.0126	6063	0.01386	5709	0.01328
CO	3.84	0.1144	3.33	0.1496	3.91	0.1334
NO_x	1630	0.01268	1113	0.00853	1352	0.01045
No. of Tests	24		28		52	

Concentration terms are ppm for HC and NO_x, percent for CO.

EVALUATION RATIO COLD START/HOT START

	TWO CITIES	HOT VS. COLD	GSA STUDY	AVERAGE	RATIO
HC = Cold Start	0.0131	0.0196	0.0163	0.0157	1.266
No. of Tests	40	26	30		
HC = Hot Start	0.0125	0.0138	0.0108	0.0124	
No. of Tests	40	26	30		
CO = Cold Start	0.198	0.177	0.1860	0.1870	1.393
No. of Tests	40	26	30		
CO = Hot Start	0.160	0.150	0.0928	0.1343	
No. of Tests	40	26	30		
NO_2 = Cold Start	0.0078	0.0106	0.0106	0.0097	1.000
No. of Tests	40	26	30		
NO_2 = Hot Start	0.0078	0.0085	0.0121	0.0094	
No. of Tests	40	26	30		

No statistical difference in NO_2 emissions. Refer to Reference #2, Hot vs. Cold Start.

Emissions are in lbs/mile.

References:

1. "A Comparison of Automotive Emissions in Cities at Low and High Altitudes," Figures 5 and 6. (Cincinnati and Los Angeles data combined with nitrogen dioxide from raw data) Cold start values were calculated from cold start to hot start ratios of: HC 1.2; CO 1.38; NO_2 1.0 (refer to Table 2 of Reference 2).

2. "Automotive Emissions After Hot and Cold Starts in Summer and Winter" (from raw data reduced to data values when ambient temperature above 50° F).

3. "GSA-Cincinnati Data."

1.5 Conversion Hot 25 mph Road to Hot 45 mph Road

Speed conversion is based on combined Los Angeles and Cincinnati data reported in "A Comparison of Automotive Emissions in Cities at Low and High Altitudes," Figures 5 and 6.

HC - 45 mph	0.0366	0.679	NO emission is a complex function of load and driving acceleration-deceleration. It was presumed that the ratio is unity.
25 mph	0.0127		
CO - 45 mph	0.098	0.612	
25 mph	0.160		
NO_2		1.000	

Automobile population was uncontrolled, with no distinction on mileage or transmission type. The pertinent information from the combined data follows.

The curves for actual road automotive emissions are based on private automobiles in Los Angeles and in Cincinnati, as reported in "Summary Report of Vehicular Emissions and Their Control" by Andrew H. Rose, Jr. (December 1968). The empirical relationship is log (emissions in pounds/mile) = intercept + slope [log (average route speed in mph)]. The intercept and slope were found by a least squares regression. The average route speeds were from 5 mph to 55 mph.

The 95% confidence limits were calculated for the total national automotive population using:

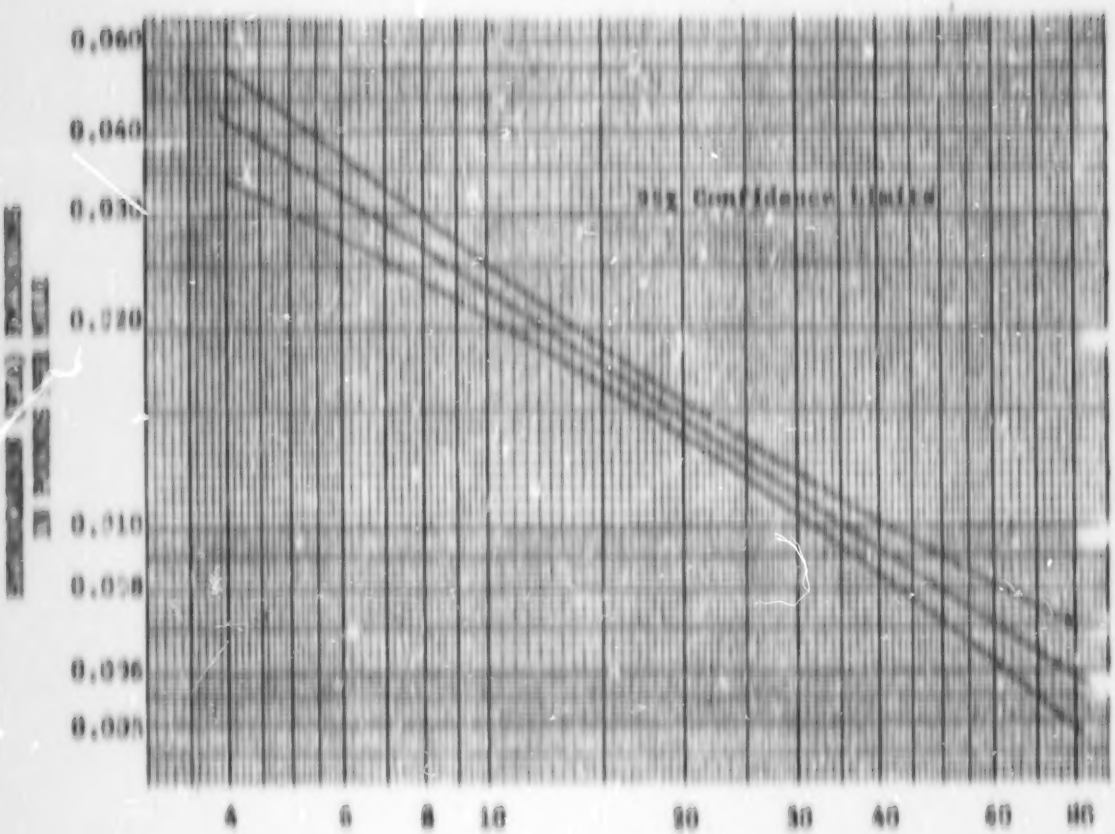
$$\hat{Y}_i \pm t_{(n-2,\ 1-\alpha/2)}\ s \left[\frac{1}{n} + \frac{(X_i - \mu)^2}{\sum (X_j - \mu)^2}\right]^{0.5}$$

$$\hat{Y}_i = b_0 + b_1 X_i$$

where:

b_0, b_1	intercept and slope as evaluated by least squares regression analysis
X_i	logarithm to base 10 of average route speed in MPH
$\hat{Y}_i$	logarithm to base 10 of predicted emissions in pounds per mile traveled
s	standard error of the estimate
n	number of data points
μ	mean value
$t_{(n-2,\ 1-\alpha/2)}$	"t" value for $(1-\alpha)$% confidence limits, two-tailed

HYDROCARBON (FIA) EMISSIONS VS AVERAGE ROUTE SPEED
(COMBINED LOS ANGELES & CINCINNATI PRIVATE AUTOMOBILES)



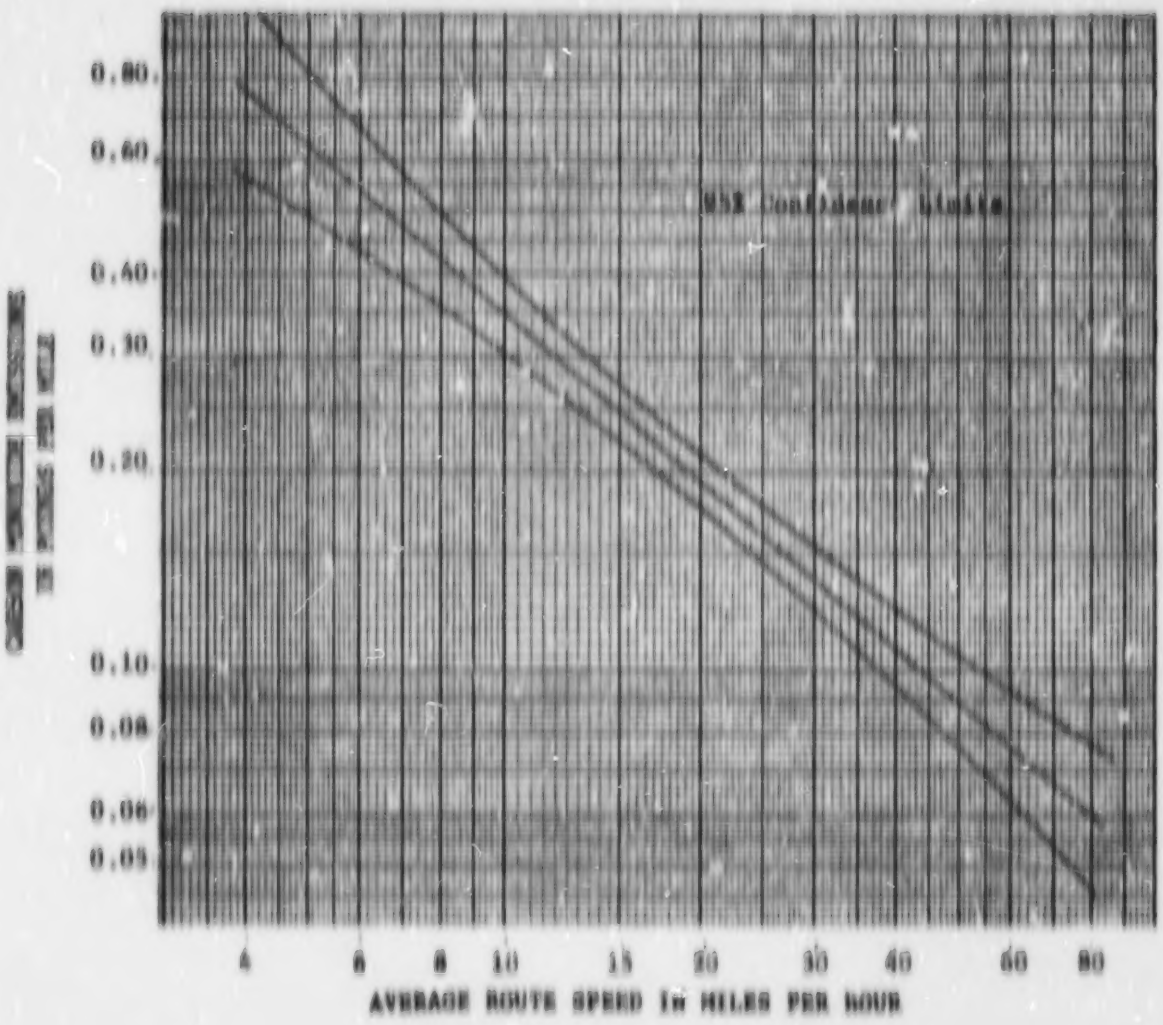
SAMPLE LINEAR REGRESSION

(COMBINED LOS ANGELES AND CINCINNATI PRIVATE AUTOMOBILES)

LOG AVG ROUTE SPEED VS LOG FIA LB/MI

SUMX	+.2079338716+03
SUMY	-.2938158246+03
SUM OF CROSSPRODUCTS	-.3876280266+03
SUM OF SQUARES X	+.2790368536+03
SUM OF SQUARES Y	+.5480263129+03
N	+.1600000000+03
ANTILOG (XBAR)	+.1993335709+02
ANTILOG (YBAR)	+.1457642747-01
TOTAL SUM OF SQUARES	+.8478145311+01
REGRESSION SUM SQUARES	+.3805599324+01
SLOPE	-.6571886799+00
INTERCEPT	-.9822793449+00
ERROR SUM OF SQUARES	+.4672545987+01
ERROR VARIANCE	+.2957307586-01
STD. ERROR OF ESTIMATE	+.1719682408+00
STD. ERROR OF SLOPE	+.7282078153+00
VARIANCE X	+.5541735437-01
VARIANCE Y	+.3332164862-01
STANDARD DEVIATION X	+.2354088048+00
STANDARD DEVIATION Y	+.1829148514+00
CORRELATION COEFFICIENT	-.6699788648+00

CARBON MONOXIDE EMISSIONS VS AVERAGE ROUTE SPEED
(COMBINED LOS ANGELES & CINCINNATI PRIVATE AUTOMOBILES)



SIMPLE LINEAR REGRESSION
(COMBINED LOS ANGELES AND CINCINNATI PRIVATE AUTOMOBILES)

LOG AVG ROUTE SPEED VS LOG CO LB/MI

SUMX	+.3079328716+03
SUMY	-.1138795058+03
SUM OF CROSSPRODUCTS	-.1334703977+03
SUM OF SQUARES X	+.2790368538+03
SUM OF SQUARES Y	+.9798746648+02
N	+.1600000000+03
ANTILOG (XBAR)	+.1993335709+02
ANTILOG (YBAR)	+.1942017274+00
TOTAL SUM OF SQUARES	+.1693407989+02
REGRESSION SUM SQUARES	+.6384419794+01
SLOPE	-.8492127278+00
INTERCEPT	+.3918733456+00
ERROR SUM OF SQUARES	+ 1057966010+02
ERROR VARIANCE	+.6685987406-01
STD. ERROR OF ESTIMATE	+.2587660604+00
STD. ERROR OF SLOPE	+.1095757371+01
VARIANCE X	+.5541735137-01
VARIANCE Y	+.1065036471+00
STANDARD DEVIATION X	+.2354089088+00
STANDARD DEVIATION Y	+.3263489652+00
CORRELATION COEFFICIENT	-.5135720100+00

1.6 Conversion Summer to Mean Annual

All previous factors have been evaluated under summer conditions. Data were taken from "Automotive Emissions after Hot and Cold Starts in Summer and Winter" for converting mean annual values presuming equal amounts of summer and winter weather conditions, and that speed and mileage do not affect the ratio. All data were taken at 25 mph. Seasonal fuel changes are included in the seasonal factor.

	Winter/Summer	Annual/Summer
HC - Cold Start	1.24	1.120
CO - " "	1.17	1.085
NO_x - " "	1.52	1.360
HC - Hot Start	1.00	1.000
CO - " "	0.84	0.930
NO_x - " "	1.59	1.295

The pertinent table from the reference is attached.

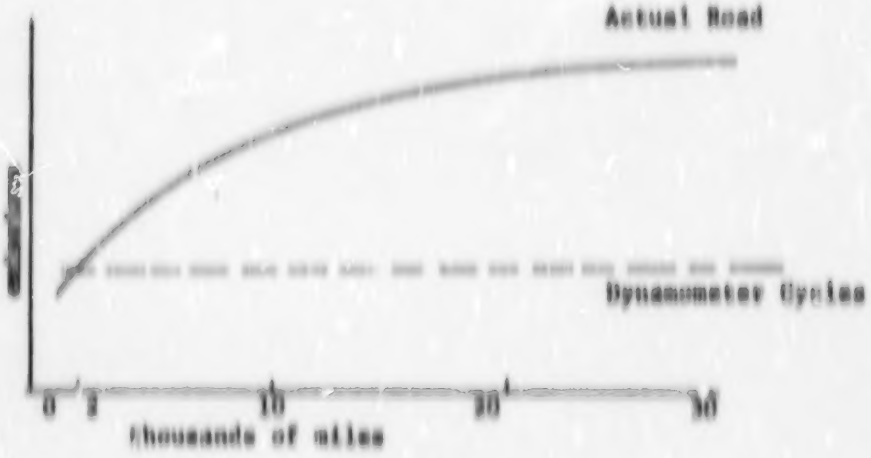
| | | |

2. DETERIORATION

It was assumed that exhaust emission deterioration with age is a function only of mileage traveled. The deterioration factors were based on a reference emission at 2,000 miles accumulated travel. Evaporative emissions were held constant as being independent of vehicle age. Crankcase emissions were presumed to vary with exhaust emissions.

2.1 Introduction to Exhaust Deterioration

A road emission base of 2,000 miles at summer conditions was chosen to directly relate road data and Federal dynamometer cycle emissions. Federal standards are based on dynamometer mileages of 50,000 miles. No deterioration occurs during these dynamometer tests after the initial "break-in" of the engine. In actual road usage, however, engine deterioration is erratic until this "break-in" occurs (around 2,000 miles), after which the engine deterioration increases to an asymptotic value. The equivalence of the Federal dynamometer standards based on 50,000 miles and the actual road emissions at 2,000 miles were assumed. The choice of summer conditions was governed by ambient conditions during indoor dynamometer runs.



3.3 Deterioration Factors

Road deterioration of automobiles for model years 1966, 1967, and 1968 was obtained from "Supplemental Progress Report #13" of the California Air Resources Laboratory. The deterioration of hydrocarbon and of carbon monoxide exhaust emissions was evaluated separately for each of these nine groups - manufacturer (Ford, General Motors, Chrysler) and model year (1966, 1967, and 1968). Least-mean-square analysis of the exhaust data fitted to an equation of the form, $XDeter = a + b \ln(x + 1)$[where x is mileage in thousands, η is a reference mileage, and XDeter (exhaust emission value at x mileage) ÷ (exhaust emission value at η mileage)], indicated that deterioration of hydrocarbon emissions is significantly different from deterioration of carbon monoxide, and that the deterioration rate for a pollutant is not affected by manufacturer, model year, or degree of control.

All exhaust data were then reduced to the ratio, XDeter (based on $\eta = 4$) and the mean value of XDeter for each reported mileage determined. Simultaneous smoothing of 1) the curve XDeter vs odometer reading, and 2) the slope of XDeter, generated smooth deterioration curves for hydrocarbon and for carbon monoxide exhaust emissions. The curves were extrapolated to an odometer reading of 3,000 miles and new deterioration factor curves, Deter, based on the 3,000 mile value were generated.

The deterioration curves approach asymptotic values of 1.20% for hydrocarbon emissions and 1.30% for carbon monoxide emissions. Data reported by Pahnke, J. A., et al. (in "Effect of Combustion Chamber Deposits and Driving Conditions on Vehicle Exhaust Emissions" -

Paper SAE 690017 at the International Automotive Engineering Congress, Detroit, Michigan, January 13-17, 1969) show an asymptotic value for hydrocarbon of 1.196.

2.3 Annual Deterioration Factors

An annual mean deterioration factor was determined for automobiles and LDT by establishing the mean value between the mileage at the beginning and end of the year. Deterioration depends primarily on mileage accumulation so the values are the same for urban and rural. No data were available for NOx deterioration; the deterioration by year was assumed to be the same as for automobiles. The raw mileage data were obtained from the 1967 issue of "Automotive Facts and Figures." The auto mileage was smoothed and the LDT mileage accumulation calculated as being proportional to the ratio of the mean yearly mileages, given as 9,300 miles for automobiles and 10,000 miles for LDT.

Value Relations
Value estimations at 3,000 Miles

MEAN ANNUAL DETERIORATION FACTORS
(BASED ON 2,000 MILES)

	AUTOMOBILES				LIGHT DUTY TRUCKS			
	(Thousands)				(Thousands)			
AGE	YEARLY MILEAGE	ACCUM. MILEAGE	D(HC)	D(CO)	YEARLY MILEAGE	ACCUM. MILEAGE	D(HC)	D(CO)
1	13.2	13.2	1.055	1.063	14.2	14.2	1.065	1.075
2	12.0	25.2	1.145	1.165	12.9	27.1	1.150	1.170
3	11.0	36.2	1.175	1.210	11.8	38.9	1.178	1.215
4	9.6	45.8	1.190	1.235	10.3	49.2	1.192	1.242
5	9.4	55.2	1.195	1.252	10.1	59.3	1.198	1.257
6	8.7	63.8	1.198	1.265	9.4	68.7	1.200	1.268
7	8.6	72.5	1.200	1.275	9.2	77.9	1.200	1.280
8	8.1	80.6	1.200	1.285	8.7	86.6	1.201	1.288
9	7.3	87.9	1.201	1.292	7.8	94.4	1.201	1.295
10	7.0	94.9	1.201	1.296	7.5	101.9	1.202	1.300
11	5.7	100.6	1.202	1.299	6.1	108.0	1.202	1.302
12	4.9	105.5	1.202	1.301	5.3	113.3	1.203	1.303
13	4.3	109.8	1.203	1.303	4.6	117.9	1.203	1.304
14	4.3	114.1	1.203	1.303	4.6	122.5	1.203	1.305
15	4.3	118.4	1.203	1.304	4.6	127.1	1.203	1.305
16	4.3	122.7	1.203	1.305	4.6	131.7	1.203	1.305
17	4.3	127.0	1.203	1.305	4.6	136.3	1.203	1.305
18	4.3	131.3	1.203	1.305	4.6	140.9	1.203	1.305
19	4.3	135.6	1.203	1.305	4.6	145.5	1.203	1.305
20	4.3	139.9	1.203	1.305	4.6	150.1	1.203	1.305

3. REFERENCE EMISSION VALUES

Each vehicle type was characterised by a reference emission value taken as the composite cycle emissions after 2,000 miles' travel. Automotive emissions were the baseline for truck emissions, making the tacit assumption that changes in automotive emissions were followed by equivalent changes in truck emissions.

3.1 Automotive Emissions at 2,000 Miles, Summer Conditions

3.1.1 Automotive Emissions - 1962

Uncontrolled emissions from an automobile population with a mean age of five years were reported by A. H. Rose, Jr. in "Summary Report of Vehicular Emissions and Their Control," December 1968. Mean age was 5 years.

Crankcase emissions were 0.0083 lb/mile hydrocarbon. Crankcase emissions were assumed to deteriorate with exhaust hydrocarbons. The five-year deterioration factor developed for exhaust hydrocarbons was used to provide crankcase emissions at 2,000 mile baseline conditions.

Evaporative losses from tank breathing and carburetor hot soak were 0.0026 lb/mile and 0.0035 lb/mile. The total of 0.0061 lb/mile was assumed independent of the age of the vehicle. Exhaust emissions were 0.0157 lb/mile hydrocarbon, 0.1870 lb/mile carbon monoxide, and 0.0097 lb/mile nitrogen oxides (as NO_2). The hydrocarbon and carbon monoxide values were brought to a 2,000 mile baseline using the appropriate five-year deterioration factors.

Pertinent tables from the reference are attached.

TYPICAL EXHAUST ROAD EMISSIONS AT AN AVERAGE ROAD SPEED OF 25 mph UNCONTROLLED CARS

COMPONENT	EXHAUST EMISSIONS			
	CONCENTRATION BASIS		MASS BASIS	
	CONC.	%	lb/mile	%
CARBON MONOXIDE, CO % AND MASS	3.84		0.187	
OXIDES OF NITROGEN, NO_x ppm AND MASS	1116		0.0097	
HYDROCARBONS, ppm HC AND MASS	1760		0.0157	
COMPOSITION % OF TOTAL				
PARAFFINS				
C_1 - C_3 PLUS BENZENE		31.6		15.5
C_4 AND HEAVIER		13.4		26.1
OLEFINS				
C_3 AND HEAVIER		13.4		16.4
ETHYLENE		13.5		7.7
AROMATICS TOTAL LESS BENZENE		10.5		21.9
ACETYLENES		17.7		10.3

Motor Vehicle Emission Lab
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TYPICAL EVAPORATIVE ROAD EMISSIONS AT AN AVERAGE ROAD SPEED OF 25 mph UNCONTROLLED CARS

COMPONENT	MASS BASIS			
	TANK EVAPORATION,		CARBURETOR HOT SOAK,	
	lb/mile	%	lb/mile	%
CARBON MONOXIDE, CO % AND MASS				
OXIDES OF NITROGEN, NO_x ppm AND MASS				
HYDROCARBONS, ppm HC AND MASS	0.0026		0.0036	
COMPOSITION % OF TOTAL				
PARAFFINS				
C_1 - C_3 PLUS BENZENE		2.9		1.1
C_4 AND HEAVIER		78.1		78.6
OLEFINS				
C_3 AND HEAVIER		30.6		16.7
ETHYLENE		–		–
AROMATICS				
TOTAL LESS BENZENE		4.4		4.4
ACETYLENES		–		–

TYPICAL CRANKCASE ROAD EMISSIONS AT AN AVERAGE ROAD SPEED OF 25 mph UNCONTROLLED CARS

COMPONENT	CRANKCASE EMISSIONS			
	CONCENTRATION BASIS		MASS BASIS	
	CONC.	%	lb/mile	%
CARBON MONOXIDE, CO % AND MASS	Trace			
OXIDES OF NITROGEN, NO_x ppm AND MASS	Trace			
HYDROCARBONS, ppm HC AND MASS	18060		0.0093	
COMPOSITION % OF TOTAL				
PARAFFINS				
C_1 - C_3 PLUS BENZENE		2.6		1.9
C_4 AND HEAVIER		51.8		48.2
OLEFINS				
C_3 AND HEAVIER		10.7		6.8
ETHYLENE		0.9		–
AROMATICS				
TOTAL LESS BENZENE		34.2		41.2
ACETYLENES		0.4		0.4

REFERENCE EMISSIONS FOR UNCONTROLLED AUTOMOBILES

	EXHAUST NO_x	EXHAUST CO	EXHAUST HC	CRANKCASE HC	EVAP. HC	UNITS
Mean Emissions for Summer Cold Start (mean vehicular age = 5 years)	0.0097	0.1870	0.0157	0.3083	0.0061	lb/mile
	4.400	84.823	7.133	3.785	2.767	gm/mile
Five Year Deterioration Factor	1.000	1.252	1.195	1.195	1.000	
Emissions for Summer Cold Start @ 2,000 miles	4.400	67.750	5.960	3.151	2.767	gm/mile
Reference Emissions (Summer Composite Cycle @ 2,000 miles)	5.757	87.234	5.678	3.151	2.767	gm/mile

3.1.3 Automotive Emissions, 1963-1967

There were no crankcase emissions, while exhaust and evaporative emissions were the same as for previous years.

3.1.3 Automotive Emissions, 1968-1969

Exhaust specifications call for 275 ppm HDIB hexane hydrocarbons and for 10% carbon monoxide, using equations in Federal Register, Vol. 33, No. 108, Part II. Conversion to gm/mile was based on a composite automobile representing sales distribution for 1968. Vehicle GVW was 4,000 pounds with a composite transmission of 82.68% automatic and 17.32% manual (based on 1968 data, 89% of the domestic vehicles had automatic transmissions, 10% of the foreign vehicle population had automatic transmissions, and that 93% of the total automotive population was domestic.

SUMMARY CALCULATIONS 4,000 GVW

Transmission

Automatic	71.95 cu ft/mile	Refer Federal Register, op cit p 8315
Manual	64.64 " " "	
Composite	70.68 " " "	

Using equations from Federal Register, p 8315
Exhaust Hydrocarbon = 3.428 gm/mile
Exhaust Carbon Monoxide = 35.103 gm/mile

3.1.4 Automotive Emissions, 1970

Emissions are stated in Federal Register, op cit, p 8306 (885.21).

Exhaust Hydrocarbon = 2.200 gm/mile
Exhaust Carbon Monoxide = 23.000 gm/mile

3.1.5 Automotive Emissions, 1971-1974

Evaporative emissions are specified in Federal Register, op cit, §85.21(a), p 8306. (Reference: Bob Kramer - value is equivalent to 0.490 gm/mile hydrocarbon)

3.1.6 Automotive Emissions, 1975-1990

Exhaust reduction was based on proportional reduction from 1974 emissions shown in "Report of the Panel on Electrically Powered Vehicles," Part I, p 33 (attached). Values are for summer composite cycle at 3,000 miles.

Exhaust Hydrocarbon = $\frac{(.30)}{(1.80)}$ 2.2 = 0.611 gm/mile

Exhaust Carbon Monoxide = (0.5/1.0) 23.0 = 11.500 gm/mile

Exhaust Nitrogen Oxides = (250/1500)5.757 = 0.960 gm/mile

In addition, it was assumed that there will be no evaporative emissions.

§ 85.5 Special test procedures.

The Secretary may, on the basis of a written application therefor by a manufacturer, prescribe test procedures (other than those set forth in this part) for devices or systems capable of preventing or reducing emissions to the atmosphere from a motor vehicle or motor vehicle engine so as to satisfy the standards of this part if he determines that such devices or systems are not susceptible to satisfactory testing by the procedures set forth herein.

Subpart B—Crankcase Emissions (Gasoline Engines)

§ 85.10 Applicability.

The provisions of this subpart are applicable to all new gasoline powered light duty vehicles and engines except motorcycles and motorcycle engines, beginning with the 1970 model year for such vehicles and engines and to all new gasoline powered engines manufactured on or after January 1, 1970 for use in heavy duty vehicles.

§ 85.11 Standard for crankcase emissions.

No crankcase emissions shall be discharged into the ambient atmosphere from any new motor vehicle or new motor vehicle engine subject to this subpart.

§ 85.12 Standards for crankcase emission control systems and devices.

The manufacturer of any new motor vehicle or new motor vehicle engine on or in which a system or device is installed or incorporated to comply with the requirements of § 85.11 shall, prior to any of the actions specified in section 203(a)(1) of the Act, test, or cause to be tested, each motor vehicle or engine in accordance with good engineering practice to ascertain that vehicles or engines so equipped and maintained in accordance with the manufacturer's recommendations can be expected to meet the requirements of § 85.11 for not less than 1 year after sale and delivery to the ultimate purchaser.

Subpart C—Exhaust Emissions and Fuel Evaporative Emissions (Gasoline Engines) (Light Duty Vehicles)

§ 85.20 Applicability.

(a) The exhaust emission provisions of this subpart are applicable to new gasoline powered light duty motor vehicles and engines beginning with the model year 1970 for such vehicles and engines except: Motorcycles and motorcycle engines, and motor vehicles with an engine displacement of less than 50 cubic inches.

(b) (1) The fuel evaporative emissions provisions of this subpart are applicable to new gasoline powered light duty motor vehicles and engines beginning with the model year 1971 for such vehicles and engines except: Off-road utility vehicles, motorcycles, and motorcycle engines and motor vehicles with an engine displacement of less than 50 cubic inches.

(2) The fuel evaporative emissions provisions of this subpart are applicable to new off-road utility vehicles and engines beginning with the model year 1975 for such vehicles and engines.

§ 85.21 Standards for exhaust emissions.

(a) Exhaust emissions from new light duty vehicles and engines subject to this subpart shall not exceed:

(1) Hydrocarbons—0.5 grams per vehicle mile.

(2) Carbon monoxide—85 grams per vehicle mile.

(b) The standards set forth in paragraph (a) of this section refer to a composite sample representing the driving cycle set forth in the applicable sections of "Test Procedures for Vehicle and Engine Exhaust and Fuel Evaporative Emissions (Gasoline Engines) (Light Duty Vehicles)" of this part and measured and calculated in accordance with those procedures: *Provided*, That for any light duty vehicle or engine equipped with a fuel evaporative emission control system or device which meets the standards of § 85.22 prior to the applicability of the fuel evaporative emission control provisions of this subpart to such vehicles or engines, the exhaust emissions shall be calculated in accordance with § 85.87 (a)(3).

§ 85.22 Standard for fuel evaporative emissions.

(a) Fuel evaporative emissions from new gasoline powered light duty vehicles and engines subject to this subpart shall not exceed: Hydrocarbons—6 grams per test.

(b) The standard set forth in paragraph (a) of this section refers to a composite sample representing the fuel evaporative emissions under the conditions set forth in the "Test Procedures for Vehicle and Engine Exhaust and Fuel Evaporative Emissions (Gasoline Engines) (Light Duty Vehicles)" of this part and measured in accordance with those procedures.

§ 85.23 Standards for exhaust and fuel evaporative emission control systems and devices.

The manufacturer of any new motor vehicle or new motor vehicle engine (or in which a system or device is incorporated or installed to comply with the requirements of §§ 85.21 and 85.22 shall, prior to any of the actions specified in section 203(a)(1) of the Act, test, or cause to be tested such motor vehicle or engine in accordance with the "Test Procedures for Vehicle and Engine Exhaust and Fuel Evaporative Emissions (Gasoline Engines) (Light Duty Vehicles)" of this part to ascertain that the lifetime emissions of motor vehicles or engines so equipped, as measured and calculated in accordance with those procedures, and tested for durability as therein set forth, will meet the requirements of §§ 85.21 and 85.22, as applicable.

Subpart D—Exhaust Emissions (Gasoline Engines for Use in Heavy Duty Vehicles)

§ 85.30 Applicability.

The provisions of this subpart are applicable to new gasoline powered engines manufactured on or after January 1, 1970, for use in heavy duty vehicles.

§ 85.31 Standards for exhaust emissions.

(a) Exhaust emissions from new gasoline engines subject to this subpart shall not exceed:

(1) Hydrocarbons—275 p.p.m.

(2) Carbon monoxide—1.5 percent by volume.

(b) The standards set forth in paragraph (a) of this section refer to a composite sample representing the operating cycles set forth in the applicable sections of "Test Procedures for Engine Exhaust Emissions (Gasoline Engines for Use in Heavy Duty Vehicles)" of this part and measured in accordance with those procedures.

§ 85.34 Standards for exhaust emission control systems and devices.

The manufacturer of any new motor vehicle engine on or in which a system or device is incorporated or installed to comply with the requirements of § 85.31 shall, prior to any of the actions specified in section 203(a)(1) of the Act, test or cause to be tested such motor vehicle engine in accordance with the "Test Procedures for Engine Exhaust Emissions (Gasoline Engines for Use in Heavy Duty Vehicles)" of this part to ascertain that the lifetime emissions of engines so equipped, as measured and calculated in accordance with those procedures, and tested for durability as therein set forth, will meet the requirements of § 85.31.

Subpart E—Exhaust Emissions (Diesel Engines for Use in Heavy Duty Vehicles)

§ 85.40 Applicability.

The provisions of this subpart are applicable to all new diesel engines manufactured on or after January 1, 1970, for use in heavy duty vehicles.

§ 85.41 Standards for exhaust smoke.

(a) The opacity of smoke emissions from new diesel engines subject to this subpart shall not exceed:

(1) 40 percent during the engine acceleration mode.

(2) 20 percent during the engine lugging mode.

(b) The standards set forth in paragraph (a) of this section refer to exhaust smoke emissions generated under the conditions set forth in the "Test Procedures for Engine Exhaust Emissions (Diesel Engines for Use in Heavy Duty Vehicles)" of this part and measured and calculated in accordance with those procedures.

§ 85.42 Standards for exhaust smoke control systems and devices.

The manufacturer of any new diesel engine subject to this subpart shall, prior to any of the actions specified in section 203(a)(1) of the Act, test, or cause to be tested such engine in accordance with the "Test Procedures for Engine Exhaust Emissions (Diesel Engines for Use in Heavy Duty Vehicles)" of this part to ascertain that the lifetime emissions of engines so equipped, as measured and calculated in accordance with those procedures, and tested for durability as

PRESENT AND FUTURE AIRPORT/COMMUNITY NOISE CONTROL LEVELS

AUTOMOTIVE EMISSIONS
FEDERAL STANDARD COMPOSITE CYCLE

TYPE	VALUE	1968	1963-1967	1968-1969	1970	1971-1974	1975-1990
NO_2 - Exhaust	gm/mile	5.757	5.757	5.757	5.757	5.757	0.960
	ppm	1500	1500	1500	1500	1500	250
CO - Exhaust	gm/mile	87.234	87.234	35.103	23.000	23.000	11.500
	%	3.7	3.7	1.5	1.0	1.0	0.5
HC - Exhaust	gm/mile	5.678	5.678	3.420	2.200	2.200	0.611
	ppm	456	456	275	176	176	49
HC - Evaporative	gm/mile	2.767	2.767	2.767	2.767	0.490	0
HC - Crankcase	gm/mile	3.151	0	0	0	0	0

Values up to and including 1967 are based on actual road emission values, back calculated to a composite cycle at 5,000 miles, using summer conditions.

Values for 1968 and 1969 are based on Federal Emission Standards of 275 ppm and 1.5% CO, using a GVW of 4,000 lb and an exhaust volume of 70.68 cu ft/mile (which is a composite auto having a weighted transmission relative to the reported sales of automatic to manual transmission).

Values for 1970 to 1974 are Federal Standards as gm/mile, composite cycle.

Values for 1975-1990 are estimated new standards derived from Department of Commerce, The Automobile and Air Pollution: A Program for Progress, Part I, October 1967.

Concentration values are based on exhaust volume of 70.68 standard cubic feet/mile and pollutant densities of 16.33 gm/scf for hydrocarbon, 33.11 gm/scf for carbon monoxide, and 54.30 gm/scf for nitrogen dioxide.

3.2 Light Duty Truck (LDT)

Light Duty Truck reference emissions were taken to be the same as the automotive emissions.

3.3 Heavy Duty Truck (HDT)

Heavy Duty Truck exhaust emission values were obtained for each of the three classes of HDT by using scale factors to convert exhaust automotive values to exhaust HDT values. Evaporative and crankcase emissions were the same as for automobiles.

HD truck controls were presumed to be equivalent to automobiles in degree of control and implementation dates.

A scale factor was developed to convert automobile emissions to corresponding HDT emissions using the composite mean uncontrolled automobile emissions developed from 1) "A Comparison of Automotive Emissions in Cities at Low and High Altitudes," 2) "Automotive Emissions after Hot and Cold Starts in Summer and Winter," and 3) "Cincinnati CSA Data." The road HDT emissions were obtained from Ethyl Corporation's Final Report on "Exhaust Emission Analysis and Mode Cycle Development for Gasoline-Powered Trucks," CR 67-41, prepared under Contract PH 86-66-150. Truck values for each of three classes (II, III, IV) were obtained at 30% load conditions. Road conditions were hot start and summer.

CLASS	GVW
HDT (II)	8,000 - 10,000
HDT (III)	10,000 - 19,500
HDT (IV)	19,500

RATIO OF EMISSIONS: HDT TO AUTOMOTIVE

Species		NO_x Scaled #/mile	CO/CO_2 Scaled #/mile	Avg. Truck #/mile	Avg. Auto #/mile	Ratio
HDT(II)	HC-FIA	0.0481	0.0487	0.0484	0.0134	3.619
	CO	0.2536	0.2569	0.2552	0.1343	1.900
	NO_x	0.0126	0.0137	0.0126	0.0094	1.340
HDT(III)	HC-FIA	0.0535	0.0550	0.0543	0.0134	4.071
	CO	0.3294	0.3345	0.3318	0.1343	2.471
	NO_x	0.0255	0.0263	0.0259	0.0094	2.755
HDT(IV)	HC-FIA	0.0575	0.0583	0.0577	0.0134	4.653
	CO	0.3721	0.3790	0.3755	0.1343	2.796
	NO_x	0.0349	0.0355	0.0352	0.0094	3.745

The supporting tables from Ethyl Corporation Report OR 67-61 are attached.

4.1. Projection of Vehicular Mileage Distribution (Ken Goodman and Clyde Morita)

4.1.1. Autos

a. Distribution Urban/Rural

Urban Fraction of Total Mileage = 0.49 + 0.004(yr)

where yr = [(last two digits of year) - 60]

b. Distribution by age is the same for both classifications (13 yrs+ is lumped)

YR	% TOTAL	YR	% TOTAL
1	15.74	8	6.53
2	13.69	9	5.24
3	12.02	10	4.25
4	10.04	11	3.83
5	9.36	12	1.74
6	8.18	13+	2.70
7	7.55	Total	100.00

c. Total Auto Mileage

For 1960-1966, tabular values are provided.
From 1967 on, use equation developed.

Calendar Year	Auto Mileage in Billions of Miles
1960	588.1
1961	604.6
1962	629.1
1963	635.4
1964	677.6
1965	706.4
1966	744.8

Equation for succeeding years is:

$$\text{Billion Miles} = -4696.62 + 239.8\,(yr) - 3.976\,(yr)^2 + 0.02413\,(yr)^3$$

where yr = last two digits of year

4.1.2. Trucks

a. Distribution among Trucks

45.1% Total = LDT
12.6% Total = HDT(II)
8.4% Total = HDT(III)
21.8% Total = HDT(IV)

(Remaining 12.1% mileage is diesel.)

b. Distribution Urban/Rural Travel

40% Total LDT is urban
40% Total HDT(II) is urban
40% Total HDT(III) is urban
20% Total HDT(IV) is urban

c. Age distribution is constant for all truck classifications.

YR	% TOTAL	YR	% TOTAL
1	10.0	10	3.5
2	9.5	11	3.0
3	9.0	12	4.5
4	8.5	13	4.0
5	8.0	14	3.5
6	7.5	15	3.0
7	7.0	16	2.5
8	6.5	17+	0.0
9	6.0		

d. Total Truck Mileage (Urban and Rural, all classifications including Diesel)

For 1960-1966, use tabulated values.
For 1967-1990, use equation.

Calendar Year	Truck Mileage in Billions of Miles
1960	130.8
1961	133.0
1962	137.8
1963	160.1
1964	166.9
1965	176.2
1966	178.8

Equation for succeeding years is:

$$\text{Billion Miles} = 542.21 + 31.912\,(yr) - 0.587\,(yr)^2 + (0.004063)(yr)^3$$

where yr is the last two digits of the year.

4.3 Tabular Hand Calculations of Vehicular Emissions (Urban Auto, Rural Auto, Rural LDT)

The following tabular calculation sheets consist of two types. The first contains: 1) the conversion of input data to reference emissions (grams/mile) for a specific vehicle class; and 2) the mean yearly emissions (grams/mile) for each year of operation.

The second type of sheet consists of the calculations for representative years (1960,1970,1980,1990) of the contribution to the total emissions of all model years operating during the year. This is achieved by multiplying the following terms: 1) the total mileage for the year of the vehicle class; 2) the fraction of the total mileage traveled by a model year operating during the year; and 3) the mean yearly emissions (in grams/mile) of the model year during the year. The summation over all model years operating during the year is the total emissions of the vehicle class during the year.

EMISSIONS FOR URBAN AUTOMOBILES (IN GRAMS/MILE)
YEARS PRECEDING 1963
(UNCONTROLLED)

INPUT	OPERATING CONDITIONS	HC FACTOR	HC VALUE	CO FACTOR	CO VALUE	NO_2 FACTOR	NO_2 VALUE
	Calif. Cycle						
	Hot Cycle	0.9101		0.8217		0.8743	
	Hot 55 Road	0.911		0.679		0.8743	
Input	Cold 55 Road	1.266	5.960	1.392	67.750	1.000	4.600
	Seasonal	1.130	6.675	1.085	73.509	1.260	5.543

HC = Evaporative 2.767 gm/mile
HC = Crankcase 3.151 gm/mile 60,000 miles

	HYDROCARBONS				CARBON MONOXIDE			NITROGEN DIOXIDE		
AGE	D(HC)	X-HC	TOTAL HC	AGE	D(CO)	TOTAL CO	AGE	$D(NO_2)$	TOTAL NO_2
1	1.055	10.386	13.133	1	1.063	78.140	1	1.000	5.543
2	1.145	11.251	14.018	2	1.165	85.638	2	1.000	5.543
3	1.175	11.546	14.313	3	1.210	88.946	3	1.000	5.543
4	1.190	11.693	14.460	4	1.235	90.784	4	1.000	5.543
5	1.195	11.742	14.509	5	1.252	92.033	5	1.000	5.543
6	1.198	11.772	14.539	6	1.265	92.989	6	1.000	5.543
7	1.200	11.791	14.558	7	1.275	93.724	7	1.000	5.543
8	1.200	11.791	14.558	8	1.285	94.459	8	1.000	5.543
9	1.201	11.801	14.568	9	1.292	94.974	9	1.000	5.543
10	1.201	11.801	14.568	10	1.296	95.268	10	1.000	5.543
11	1.202	11.811	14.578	11	1.299	95.488	11	1.000	5.543
12	1.202	11.811	14.578	12	1.301	95.635	12	1.000	5.543
13	1.203	11.821	14.588	13	1.302	95.709	13	1.000	5.543
14	1.203	11.821	14.588	14	1.303	95.782	14	1.000	5.543
15	1.203	11.821	14.588	15	1.304	95.856	15	1.000	5.543
16	1.203	11.821	14.588	16	1.305	95.929	16	1.000	5.543
17	1.203	11.821	14.588	17	1.305	95.929	17	1.000	5.543
18	1.203	11.821	14.588	18	1.305	95.929	18	1.000	5.543
19	1.203	11.821	14.588	19	1.305	95.929	19	1.000	5.543
20	1.203	11.821	14.588	20	1.305	95.929	20	1.000	5.543

X-HC = The total of exhaust and crankcase hydrocarbon emission.

D(HC) = Deterioration factor for HC
D(CO) = Deterioration factor for CO
$D(NO_2)$ = Deterioration factor for NO_2

EMISSIONS FOR URBAN AUTOMOBILES (IN GRAMS/MILES)
YEARS 1963 THROUGH 1967

INPUT	OPERATING CONDITIONS	HC FACTOR	HC VALUE	CO FACTOR	CO VALUE	NO_x FACTOR	NO_x VALUE
Input	Calif. Cycle		5.678		87.234		5.757
	Hot Cycle	0.9101	5.168	0.8217	71.680	0.8743	5.033
	Hot 35 Road	0.911	4.708	0.679	48.671	0.8743	4.400
	Cold 35 Road	1.266	3.960	1.392	67.730	1.000	4.400
	Seasonal	1.130	6.675	1.085	73.509	1.260	5.543

HC - Evaporative 2.767 gm/mile
HC - Crankcase None

HYDROCARBONS				CARBON MONOXIDE			NITROGEN DIOXIDE		
AGE	D(HC)	E-HC	TOTAL HC	AGE	D(CO)	TOTAL CO	AGE	$D(NO_x)$	TOTAL NO_x
1	1.055	7.042	9.809	1	1.063	78.140	1	1.000	5.543
2	1.145	7.643	10.410	2	1.165	85.638	2	1.000	5.543
3	1.175	7.843	10.610	3	1.210	88.946	3	1.000	5.543
4	1.190	7.943	10.710	4	1.238	90.784	4	1.000	5.543
5	1.195	7.977	10.744	5	1.252	92.033	5	1.000	5.543
6	1.198	7.997	10.764	6	1.263	92.989	6	1.000	5.543
7	1.200	8.010	10.777	7	1.273	93.724	7	1.000	5.543
8	1.200	8.010	10.777	8	1.285	94.459	8	1.000	5.543
9	1.201	8.017	10.784	9	1.292	94.974	9	1.000	5.543
10	1.201	8.017	10.784	10	1.296	95.268	10	1.000	5.543
11	1.202	8.023	10.790	11	1.299	95.488	11	1.000	5.543
12	1.202	8.023	10.790	12	1.301	95.635	12	1.000	5.543
13	1.203	8.030	10.797	13	1.302	95.709	13	1.000	5.543
14	1.203	8.030	10.797	14	1.303	95.782	14	1.000	5.543
15	1.203	8.030	10.797	15	1.304	95.856	15	1.000	5.543
16	1.203	8.030	10.797	16	1.305	95.929	16	1.000	5.543
17	1.203	8.030	10.797	17	1.305	95.929	17	1.000	5.543
18	1.203	8.030	10.797	18	1.305	95.929	18	1.000	5.543
19	1.203	8.030	10.797	19	1.305	95.929	19	1.000	5.543
20	1.203	8.030	10.797	20	1.305	95.929	20	1.000	5.543

E-HC = The total of exhaust and crankcase hydrocarbon emission.

D(HC) = Deterioration factor for HC
D(CO) = Deterioration factor for CO
$D(NO_x)$ = Deterioration factor for NO_x

EMISSIONS FOR URBAN AUTOMOBILES (IN GRAMS/MILES)
YEARS 1968 AND 1969

INPUT	OPERATING CONDITIONS	HC FACTOR	HC VALUE	CO FACTOR	CO VALUE	NO_2 FACTOR	NO_2 VALUE
Input	Calif. Cycle		3.438		38.103		5.787
	Hot Cycle	0.9102	3.130	0.8217	28.044	0.8743	5.033
	Hot 25 Road	0.911	2.842	0.679	19.383	0.8743	4.400
	Cold 25 Road	1.266	3.598	1.392	27.263	1.000	4.400
	Seasonal	1.130	4.030	1.085	39.980	1.260	5.543

HC = Evaporative 2.767 gm/mile
HC = Crankcase None

	HYDROCARBONS			CARBON MONOXIDE			NITROGEN DIOXIDE		
AGE	D(HC)	X-HC	TOTAL HC	AGE	D(CO)	TOTAL CO	AGE	$D(NO_2)$	TOTAL NO_2
1	1.035	4.252	7.019	1	1.063	31.444	1	1.000	5.543
2	1.145	4.614	7.381	2	1.165	34.461	2	1.000	5.543
3	1.175	4.735	7.502	3	1.210	35.795	3	1.000	5.543
4	1.190	4.796	7.563	4	1.233	36.511	4	1.000	5.543
5	1.195	4.816	7.583	5	1.252	37.034	5	1.000	5.543
6	1.198	4.828	7.595	6	1.265	37.419	6	1.000	5.543
7	1.200	4.836	7.603	7	1.275	37.715	7	1.000	5.543
8	1.200	4.836	7.603	8	1.285	38.010	8	1.000	5.543
9	1.201	4.840	7.607	9	1.292	38.217	9	1.000	5.543
10	1.201	4.840	7.607	10	1.298	38.336	10	1.000	5.543
11	1.202	4.844	7.611	11	1.299	38.424	11	1.000	5.543
12	1.202	4.844	7.611	12	1.301	38.484	12	1.000	5.543
13	1.203	4.848	7.615	13	1.302	38.513	13	1.000	5.543
14	1.203	4.848	7.615	14	1.303	38.543	14	1.000	5.543
15	1.205	4.848	7.615	15	1.304	38.573	15	1.000	5.543
16	1.203	4.848	7.615	16	1.305	38.602	16	1.000	5.543
17	1.203	4.848	7.615	17	1.305	38.602	17	1.000	5.543
18	1.203	4.848	7.615	18	1.305	38.602	18	1.000	5.543
19	1.203	4.848	7.615	19	1.305	38.602	19	1.000	5.543
20	1.203	4.848	7.615	20	1.305	38.602	20	1.000	5.543

X-HC = The total of exhaust and crankcase hydrocarbon emission.

D(HC) = Deterioration factor for HC
D(CO) = Deterioration factor for CO
$D(NO_2)$ = Deterioration factor for NO_2

EMISSIONS FOR URBAN AUTOMOBILES (IN GRAMS/MILES)
YEAR 1970

INPUT	OPERATING CONDITIONS	HC FACTOR	HC VALUE	CO FACTOR	CO VALUE	NO_2 FACTOR	NO_2 VALUE
Input	Calif. Cycle		2.200		23.000		3.757
	Hot Cycle	0.9101	2.002	0.8217	18.899	0.8743	3.033
	Hot 35 Road	0.911	1.824	0.679	12.832	0.8743	4.400
	Cold 25 Road	1.266	2.309	1.393	17.853	1.000	4.400
	Seasonal	1.130	2.586	1.085	19.381	1.260	5.545

HC = Evaporative 2.767 gm/mile
HC = Crankcase None

HYDROCARBONS				CARBON MONOXIDE			NITROGEN DIOXIDE		
AGE	D(HC)	S-HC	TOTAL HC	AGE	D(CO)	TOTAL CO	AGE	$D(NO_2)$	TOTAL NO_2
1	1.055	2.720	5.495	1	1.063	20.602	1	1.000	5.543
2	1.145	2.961	5.738	2	1.165	22.579	2	1.000	5.543
3	1.175	3.039	5.806	3	1.210	23.451	3	1.000	5.543
4	1.190	3.077	5.844	4	1.235	23.936	4	1.000	5.543
5	1.195	3.090	5.857	5	1.252	24.265	5	1.000	5.543
6	1.118	3.098	5.865	6	1.265	24.517	6	1.000	5.543
7	1.200	3.103	5.870	7	1.275	24.711	7	1.000	5.543
8	1.200	3.103	5.870	8	1.285	24.905	8	1.000	5.543
9	1.201	3.106	5.873	9	1.293	25.060	9	1.000	5.543
10	1.201	3.106	5.873	10	1.298	25.118	10	1.000	5.543
11	1.203	3.108	5.877	11	1.299	25.176	11	1.000	5.543
12	1.203	3.108	5.875	12	1.301	25.213	12	1.000	5.543
13	1.203	3.111	5.878	13	1.302	25.234	13	1.000	5.543
14	1.203	3.111	5.878	14	1.303	25.253	14	1.000	5.543
15	1.203	3.111	5.878	15	1.304	25.273	15	1.000	5.543
16	1.203	3.111	5.878	16	1.305	25.293	16	1.000	5.543
17	1.203	3.111	5.878	17	1.305	25.293	17	1.000	5.543
18	1.203	3.111	5.878	18	1.305	25.293	18	1.000	5.543
19	1.203	3.111	5.878	19	1.305	25.293	19	1.000	5.543
20	1.203	3.111	5.878	20	1.305	25.293	20	1.000	5.543

S-HC = The total of exhaust and crankcase hydrocarbon emission.

D(HC) = Deterioration factor for HC
D(CO) = Deterioration factor for CO
$D(NO_2)$ = Deterioration factor for NO_2

EMISSIONS FOR URBAN AUTOMOBILES (IN GRAMS/MILE)
YEARS 1971 THROUGH 1974

INPUT	OPERATING CONDITIONS	HC FACTOR	HC VALUE	CO FACTOR	CO VALUE	NO_x FACTOR	NO_x VALUE
Input	Calif. Cycle		2.200		23.000		3.757
	Hot Cycle	0.9101	2.003	0.8217	18.889		3.033
	Hot 25 Road	0.911	1.824	0.679	12.833		4.400
	Cold 25 Road	1.266	2.309	1.392	17.863	1.000	4.600
	Seasonal	1.120	2.586	1.085	19.381	1.260	3.543

HC = Evaporative 0.490 gm/mile
HC = Crankcase None

HYDROCARBONS

AGE	D(HC)	S-HC	TOTAL HC
1	1.055	2.728	3.218
2	1.145	2.961	3.451
3	1.175	3.039	3.529
4	1.190	3.077	3.567
5	1.195	3.090	3.580
6	1.198	3.098	3.588
7	1.200	3.103	3.593
8	1.200	3.103	3.593
9	1.201	3.106	3.596
10	1.201	3.106	3.596
11	1.202	3.108	3.598
12	1.202	3.108	3.598
13	1.203	3.111	3.601
14	1.203	3.111	3.601
15	1.203	3.111	3.601
16	1.203	3.111	3.601
17	1.203	3.111	3.601
18	1.203	3.111	3.601
19	1.203	3.111	3.601
20	1.203	3.111	3.601

CARBON MONOXIDE

AGE	D(CO)	TOTAL CO
1	1.069	20.602
2	1.165	22.570
3	1.210	23.451
4	1.238	23.936
5	1.258	24.265
6	1.265	24.517
7	1.275	24.711
8	1.285	24.905
9	1.292	25.040
10	1.296	25.118
11	1.299	25.176
12	1.301	25.215
13	1.302	25.234
14	1.303	25.253
15	1.304	25.273
16	1.305	25.292
17	1.305	25.292
18	1.305	25.292
19	1.305	25.292
20	1.305	25.292

NITROGEN DIOXIDE

AGE	$D(NO_x)$	TOTAL NO_x
1	1.000	3.543
2	1.000	3.543
3	1.000	3.543
4	1.000	3.543
5	1.000	3.543
6	1.000	3.543
7	1.000	3.543
8	1.000	3.543
9	1.000	3.543
10	1.000	3.543
11	1.000	3.543
12	1.000	3.543
13	1.000	3.543
14	1.000	3.543
15	1.000	3.543
16	1.000	3.543
17	1.000	3.543
18	1.000	3.543
19	1.000	3.543
20	1.000	3.543

S-HC = The total of exhaust and crankcase hydrocarbon emission.

D(HC) = Deterioration factor for HC
D(CO) = Deterioration factor for CO
$D(NO_x)$ = Deterioration factor for NO_x

EMISSIONS FOR URBAN AUTOMOBILES (IN GRAMS/MILE)
YEARS 1975 THROUGH 1990

INPUT	OPERATING CONDITIONS	HC FACTOR	HC VALUE	CO FACTOR	CO VALUE	NO_x FACTOR	NO_x VALUE
Input	Calif. Cycle		0.611		11.500		0.960
	Hot Cycle	0.9101	0.556	0.8217	9.450	0.8743	0.839
	Hot 23 Road	0.911	0.507	0.670	6.416	0.8743	0.734
	Cold 23 Road	1.266	0.641	1.392	8.931	1.000	0.734
	Seasonal	1.130	0.718	1.085	9.691	1.260	0.934

HC = Evaporative None
HC = Crankcase None

HYDROCARBONS				CARBON MONOXIDE			NITROGEN DIOXIDE		
AGE	D(HC)	E-HC	TOTAL HC	AGE	D(CO)	TOTAL CO	AGE	$D(NO_x)$	TOTAL NO_x
1	1.055	0.757	0.757	1	1.063	10.302	1	1.000	0.934
2	1.145	0.822	0.822	2	1.165	11.290	2	1.000	0.934
3	1.175	0.844	0.844	3	1.210	11.726	3	1.000	0.934
4	1.190	0.854	0.854	4	1.235	11.968	4	1.000	0.934
5	1.195	0.858	0.858	5	1.253	12.133	5	1.000	0.934
6	1.198	0.860	0.860	6	1.265	12.259	6	1.000	0.934
7	1.200	0.862	0.862	7	1.275	12.356	7	1.000	0.934
8	1.200	0.862	0.862	8	1.285	12.453	8	1.000	0.934
9	1.201	0.862	0.862	9	1.292	12.521	9	1.000	0.934
10	1.201	0.862	0.862	10	1.296	12.560	10	1.000	0.934
11	1.202	0.863	0.863	11	1.299	12.589	11	1.000	0.934
12	1.202	0.863	0.863	12	1.301	12.608	12	1.000	0.934
13	1.203	0.864	0.864	13	1.302	12.618	13	1.000	0.934
14	1.203	0.864	0.864	14	1.303	12.627	14	1.000	0.934
15	1.203	0.864	0.864	15	1.304	12.637	15	1.000	0.934
16	1.203	0.864	0.864	16	1.305	12.647	16	1.000	0.934
17	1.203	0.864	0.864	17	1.305	12.647	17	1.000	0.934
18	1.203	0.864	0.864	18	1.305	12.647	18	1.000	0.934
19	1.203	0.864	0.864	19	1.305	12.647	19	1.000	0.934
20	1.203	0.864	0.864	20	1.305	12.647	20	1.000	0.934

E-HC = The total of exhaust and crankcase hydrocarbon emission.

D(HC) = Deterioration factor for HC
D(CO) = Deterioration factor for CO
$D(NO_x)$ = Deterioration factor for NO_x

EMISSIONS FROM URBAN AUTOMOBILES IN 1969
TOTAL MILEAGE: 288.16 BILLION MILES

AGE	% TOTAL MILES	HC gm/mile	HC billion gm	CO gm/mile	CO billion gm	NO_x gm/mile	NO_x billion gm	MODEL YEAR
1	13.74	13.133	595.67	78.160	3544.15	5.543		1969
2	13.69	14.018	553.00	85.638	3378.36	5.543		1968
3	12.03	14.313	497.76	88.966	3080.81	5.543		1967
4	10.04	14.460	418.35	90.784	2626.50	5.543		1966
5	9.36	14.509	391.33	92.033	2482.29	5.543		1965
6	8.18	14.539	342.71	92.989	2191.89	5.543		1964
7	7.55	14.558	316.73	93.724	2039.07	5.543		1963
8	6.52	14.558	273.52	94.459	1774.70	5.543		1962
9	5.24	14.568	219.97	94.974	1434.07	5.543		1961
10	4.31	14.568	180.93	95.268	1183.20	5.543		1960
11	2.63	14.578	110.88	95.488	778.70	5.543		1959
12	1.74	14.578	73.09	95.635	479.91	5.543		1968
13+	2.78	14.588	116.86	95.709	766.71	5.543		1968
Billion gms			4096.80		25739.94		1597.17	
Million tons			4.516		28.395		1.761	

EMISSIONS FROM URBAN AUTOMOBILES IN 1970
TOTAL MILEAGE: 466.47 BILLION MILES

AGE	% TOTAL MILES	HC gm/mile	HC billion gm	CO gm/mile	CO billion gm	NO_x gm/mile	NO_x billion gm	MODEL YEAR
1	13.74	5.495	403.46	20.602	1512.69	5.543		1970
2	13.69	7.381	471.35	34.461	2200.67	5.543		1969
3	12.03	7.502	420.63	35.792	2006.85	5.543		1968
4	10.04	10.710	501.59	90.784	4251.65	5.543		1967
5	9.36	10.764	469.10	92.033	4018.31	5.543		1966
6	8.18	10.764	410.71	92.989	3548.20	5.543		1965
7	7.55	10.777	379.55	93.724	3300.82	5.543		1964
8	6.52	10.777	327.77	94.459	2872.86	5.543		1963
9	5.24	14.568	356.09	94.974	2321.15	5.543		1962
10	4.31	14.568	292.89	95.268	1915.35	5.543		1961
11	2.63	14.578	192.45	95.488	1260.55	5.543		1960
12	1.74	14.578	118.32	95.635	776.23	5.543		1959
13+	2.78	14.588	189.18	95.709	1241.14	5.543		1958
Billion gms			4533.10		31286.72		2585.64	
Million tons			4.997		34.481		2.850	

EMISSIONS FROM URBAN AUTOMOBILES IN 1980
TOTAL MILEAGE: 792.53 BILLION MILES

AGE	% TOTAL MILES	HC gm/mile	HC billion gm	CO gm/mile	CO billion gm	NO_x gm/mile	NO_x billion gm	MODEL YEAR
1	15.74	0.757	94.43	10.303	1285.11	0.924		1980
2	13.69	0.822	89.18	11.390	1236.94	0.924		1979
3	12.03	0.844	80.40	11.726	1117.04	0.924		1978
4	10.04	0.854	67.95	11.968	952.29	0.924		1977
5	9.36	0.858	63.69	12.133	900.04	0.924		1976
6	8.18	0.860	55.75	12.259	794.74	0.924		1975
7	7.55	3.393	214.99	24.711	1478.61	5.543		1974
8	6.52	3.393	185.66	24.905	1286.91	5.543		1973
9	5.24	3.396	149.34	25.040	1039.88	5.543		1972
10	4.31	3.396	122.83	25.118	857.98	5.543		1971
11	2.83	3.875	131.77	25.176	564.86	5.543		1970
12	1.74	7.611	104.96	38.484	530.70	5.543		1969
13+	2.78	7.619	167.78	38.513	848.53	5.543		1968
Billion gms			1528.39		13881.43		1866.03	
Million tons			1.685		14.199		2.057	

EMISSIONS FROM URBAN AUTOMOBILES IN 1990
TOTAL MILEAGE: 1380.58 BILLION MILES

AGE	% TOTAL MILES	HC gm/mile	HC billion gm	CO gm/mile	CO billion gm	NO_x gm/mile	NO_x billion gm	MODEL YEAR
1	15.74	0.757	164.50	10.303	2238.66	0.924		1990
2	13.69	0.822	155.36	11.390	2133.83	0.924		1989
3	12.03	0.844	140.06	11.726	1945.88	0.924		1988
4	10.04	0.854	118.37	11.968	1658.89	0.924		1987
5	9.36	0.858	110.87	12.133	1567.05	0.924		1986
6	8.18	0.860	97.12	12.259	1384.43	0.924		1985
7	7.55	0.862	89.85	12.356	1287.91	0.924		1984
8	6.52	0.862	77.59	12.453	1120.94	0.924		1983
9	5.24	0.862	62.36	12.521	905.80	0.924		1982
10	4.31	0.862	51.29	12.560	747.36	0.924		1981
11	2.83	0.863	33.72	12.589	491.86	0.924		1980
12	1.74	0.863	20.73	12.608	302.87	0.924		1979
13+	2.78	0.864	33.16	12.618	484.28	0.924		1978
Billion gms			1154.90		18370.56		1378.66	
Million tons			1.273		17.935		1.406	

EMISSIONS FOR RURAL AUTOMOBILES (IN GRAMS/MILE)
YEARS PRECEDING 1963
(UNCONTROLLED)

INPUT	OPERATING CONDITIONS	HC FACTOR	HC VALUE	CO FACTOR	CO VALUE	NO_2 FACTOR	NO_2 VALUE
Input	Calif. Cycle		5.970		87.234		5.757
	Hot Cycle	0.9101	5.166	0.8217	71.680	0.8743	5.033
	Hot 35 Road	0.911	4.708	0.679	48.671	0.8742	4.400
	Hot 45 Road	0.679	3.196	0.613	29.787	1.000	4.400
	Seasonal	1.000	3.196	0.520	37.404	1.295	5.698

HC = Evaporative 2.767 gm/mile
HC = Crankcase 3.151 gm/mile at 9,000 miles

HYDROCARBONS

AGE	D(HC)	X-HC	TOTAL HC
1	1.055	6.696	9.463
2	1.145	7.267	10.034
3	1.175	7.458	10.225
4	1.190	7.553	10.320
5	1.195	7.585	10.352
6	1.198	7.604	10.371
7	1.200	7.616	10.384
8	1.200	7.616	10.384
9	1.201	7.623	10.390
10	1.201	7.623	10.390
11	1.201	7.623	10.390
12	1.202	7.629	10.396
13	1.203	7.635	10.402
14	1.203	7.635	10.402
15	1.203	7.635	10.402
16	1.203	7.635	10.402
17	1.203	7.635	10.402
18	1.203	7.635	10.402
19	1.203	7.635	10.402
20	1.203	7.635	10.402

CARBON MONOXIDE

AGE	D(CO)	TOTAL CO
1	1.063	29.130
2	1.165	31.926
3	1.210	33.159
4	1.235	33.844
5	1.252	34.310
6	1.265	34.666
7	1.275	34.940
8	1.285	35.214
9	1.293	35.408
10	1.296	35.516
11	1.299	35.598
12	1.301	35.653
13	1.302	35.680
14	1.303	35.707
15	1.304	35.735
16	1.305	35.762
17	1.305	35.762
18	1.305	35.762
19	1.305	35.762
20	1.305	35.762

NITROGEN DIOXIDE

AGE	$D(NO_2)$	TOTAL NO_2
1	1.000	5.697
2	1.000	5.697
3	1.000	5.697
4	1.000	5.697
5	1.000	5.697
6	1.000	5.697
7	1.000	5.697
8	1.000	5.697
9	1.000	5.697
10	1.000	5.697
11	1.000	5.697
12	1.000	5.697
13	1.000	5.697
14	1.000	5.697
15	1.000	5.697
16	1.000	5.697
17	1.000	5.697
18	1.000	5.697
19	1.000	5.697
20	1.000	5.697

X-HC = The total of exhaust and crankcase hydrocarbon emissions.

D(HC) = Deterioration factor for HC
D(CO) = Deterioration factor for CO
$D(NO_2)$ = Deterioration factor for NO_2

EMISSIONS FOR RURAL AUTOMOBILES (IN GRAMS/MILE)
YEARS 1963 THROUGH 1967

INPUT	OPERATING CONDITIONS	HC FACTOR	HC VALUE	CO FACTOR	CO VALUE	NO_2 FACTOR	NO_2 VALUE
Input	Calif. Cycle		5.678		87.234		5.757
	Hot Cycle	0.9101	5.168	0.8217	71.680	0.8743	5.033
	Hot 25 Road	0.911	4.708	0.679	46.671	0.8743	4.400
	Hot 45 Road	0.679	3.196	0.612	29.787	1.000	4.400
	Seasonal	1.000	3.196	0.930	27.404	1.295	5.698

HC = Evaporative 2.767 gm/mile
HC = Crankcase None

	HYDROCARBONS			CARBON MONOXIDE			NITROGEN DIOXIDE		
AGE	D(HC)	X-HC	TOTAL HC	AGE	D(CO)	TOTAL CO	AGE	$D(NO_2)$	TOTAL NO_2
1	1.059	3.372	6.139	1	1.063	29.130	1	1.000	5.698
2	1.145	3.659	6.426	2	1.165	31.926	2	1.000	5.698
3	1.175	3.755	6.522	3	1.210	33.159	3	1.000	5.698
4	1.190	3.803	6.570	4	1.235	33.844	4	1.000	5.698
5	1.195	3.819	6.586	5	1.253	34.310	5	1.000	5.698
6	1.198	3.829	6.596	6	1.265	34.666	6	1.000	5.698
7	1.200	3.835	6.602	7	1.275	34.940	7	1.000	5.698
8	1.200	3.835	6.602	8	1.283	35.214	8	1.000	5.698
9	1.201	3.838	6.605	9	1.291	35.406	9	1.000	5.698
10	1.201	3.838	6.605	10	1.296	35.516	10	1.000	5.698
11	1.202	3.842	6.609	11	1.299	35.598	11	1.000	5.698
12	1.202	3.842	6.609	12	1.301	35.653	12	1.000	5.698
13	1.203	3.845	6.612	13	1.302	35.680	13	1.000	5.698
14	1.203	3.845	6.612	14	1.303	35.707	14	1.000	5.698
15	1.204	3.845	6.612	15	1.304	35.735	15	1.000	5.698
16	1.203	3.845	6.612	16	1.305	35.762	16	1.000	5.698
17	1.203	3.845	6.612	17	1.305	35.762	17	1.000	5.698
18	1.203	3.845	6.612	18	1.305	35.762	18	1.000	5.698
19	1.203	3.845	6.612	19	1.305	35.762	19	1.000	5.698
20	1.203	3.845	6.612	20	1.305	35.762	20	1.000	5.698

X-HC = The total of exhaust and crankcase hydrocarbon emission.

D(HC) = Deterioration factor for HC
D(CO) = Deterioration factor for CO
$D(NO_2)$ = Deterioration factor for NO_2

EMISSIONS FOR RURAL AUTOMOBILES (IN GRAMS/MILE)
YEARS 1968 AND 1969

INPUT	OPERATING CONDITIONS	HC FACTOR	HC VALUE	CO FACTOR	CO VALUE	NO_2 FACTOR	NO_2 VALUE
Input	Calif. Cycle		3.428		35.103		5.757
	Hot Cycle	0.9101	3.120	0.8217	28.844	0.8743	5.033
	Hot 35 Road	0.911	2.842	0.673	19.585	0.8742	4.400
	Hot 45 Road	0.679	1.930	0.618	11.966	1.000	4.400
	Seasonal	1.000	1.930	0.930	11.027	1.295	5.698

HC = Evaporative 2.767 gm/mile
HC = Crankcase None

HYDROCARBONS				CARBON MONOXIDE			NITROGEN DIOXIDE		
AGE	$\bar{D}$(HC)	E-HC	TOTAL HC	AGE	$\bar{D}$(CO)	TOTAL CO	AGE	$\bar{D}(NO_2)$	TOTAL NO_2
1	1.033	2.036	4.803	1	1.063	11.733	1	1.000	5.698
2	1.148	2.210	4.977	2	1.165	13.046	2	1.000	5.698
3	1.175	2.268	5.035	3	1.210	13.563	3	1.000	5.698
4	1.190	2.297	5.064	4	1.235	13.818	4	1.000	5.698
5	1.195	2.306	5.073	5	1.252	13.986	5	1.000	5.698
6	1.198	2.312	5.079	6	1.265	13.949	6	1.000	5.698
7	1.200	2.316	5.083	7	1.275	14.059	7	1.000	5.698
8	1.200	2.316	5.083	8	1.285	14.170	8	1.000	5.698
9	1.201	2.318	5.085	9	1.293	14.267	9	1.000	5.698
10	1.201	2.318	5.085	10	1.298	14.291	10	1.000	5.698
11	1.202	2.320	5.087	11	1.299	14.324	11	1.000	5.698
12	1.202	2.320	5.087	12	1.301	14.346	12	1.000	5.698
13	1.203	2.322	5.089	13	1.302	14.357	13	1.000	5.698
14	1.203	2.322	5.089	14	1.303	14.368	14	1.000	5.698
15	1.203	2.322	5.089	15	1.304	14.379	15	1.000	5.698
16	1.203	2.322	5.089	16	1.305	14.390	16	1.000	5.698
17	1.203	2.322	5.089	17	1.305	14.390	17	1.000	5.698
18	1.203	2.322	5.089	18	1.305	14.390	18	1.000	5.698
19	1.203	2.322	5.089	19	1.305	14.390	19	1.000	5.698
20	1.203	2.322	5.089	20	1.305	14.390	20	1.000	5.698

E-HC = The total of exhaust and crankcase hydrocarbon emission.

$\bar{D}$(HC) = Deterioration factor for HC
$\bar{D}$(CO) = Deterioration factor for CO
$\bar{D}(NO_2)$ = Deterioration factor for NO_2

EMISSIONS FOR RURAL AUTOMOBILES (IN GRAMS/MILE)
YEAR 1970

INPUT	OPERATING CONDITIONS	HC FACTOR	HC VALUE	CO FACTOR	CO VALUE	NO_x FACTOR	NO_x VALUE
Input	Calif. Cycle		2.200		23.000		5.757
	Hot Cycle	0.9101	2.002	0.8217	8.899	0.8743	5.034
	Hot 35 Road	0.911	1.824	0.679	12.832	0.8742	4.400
	Hot 45 Road	0.679	1.239	0.612	7.853	1.000	4.400
	Seasonal	1.000	1.239	0.920	7.225	1.295	5.698

HC = Evaporative 2.767 gm/mile
HC = Crankcase None

HYDROCARBONS				CARBON MONOXIDE			NITROGEN DIOXIDE		
AGE	D(HC)	E-HC	TOTAL HC	AGE	D(CO)	TOTAL CO	AGE	$D(NO_x)$	TOTAL NO_x
1	1.055	1.307	4.074	1	1.063	7.680	1	1.000	5.698
2	1.155	1.419	4.186	2	1.165	8.417	2	1.000	5.698
3	1.175	1.450	4.223	3	1.210	8.742	3	1.000	5.698
4	1.190	1.474	4.241	4	1.235	8.923	4	1.000	5.698
5	1.195	1.481	4.248	5	1.252	9.046	5	1.000	5.698
6	1.198	1.486	4.251	6	1.265	9.140	6	1.000	5.698
7	1.200	1.487	4.256	7	1.275	9.212	7	1.000	5.698
8	1.200	1.487	4.256	8	1.283	9.268	8	1.000	5.698
9	1.201	1.488	4.255	9	1.292	9.335	9	1.000	5.698
10	1.201	1.488	4.255	10	1.296	9.364	10	1.000	5.698
11	1.202	1.489	4.256	11	1.299	9.385	11	1.000	5.698
12	1.202	1.489	4.256	12	1.301	9.400	12	1.000	5.698
13	1.203	1.491	4.258	13	1.302	9.407	13	1.000	5.698
14	1.203	1.491	4.258	14	1.303	9.414	14	1.000	5.698
15	1.203	1.491	4.258	15	1.304	9.421	15	1.000	5.698
16	1.203	1.491	4.258	16	1.305	9.429	16	1.000	5.698
17	1.203	1.491	4.258	17	1.305	9.429	17	1.000	5.698
18	1.203	1.491	4.258	18	1.305	9.429	18	1.000	5.698
19	1.203	1.491	4.258	19	1.305	9.429	19	1.000	5.698
20	1.203	1.491	4.258	20	1.305	9.429	20	1.000	5.698

E-HC = The total of exhaust and crankcase hydrocarbon emission.

D(HC) = Deterioration factor for HC
D(CO) = Deterioration factor for CO
$D(NO_x)$ = Deterioration factor for NO_x

EMISSIONS FOR RURAL AUTOMOBILES (IN GRAM/MILE)
YEAR 1970

INPUT	OPERATING CONDITIONS	HC FACTOR	HC VALUE	CO FACTOR	CO VALUE	NO_2 FACTOR	NO_2 VALUE
Input	Calif. Cycle		2.200		23.000		5.757
	Hot Cycle	0.9101	2.002	0.8217	6.899	0.8743	5.033
	Hot 35 Road	0.911	1.824	0.679	12.832	0.8742	4.600
	Hot 45 Road	0.679	1.339	0.612	7.853	1.000	4.400
	Seasonal	1.000	1.339	0.920	7.225	1.295	5.698

HC = Evaporative 2.767 gm/mile
HC = Crankcase None

HYDROCARBONS				CARBON MONOXIDE			NITROGEN DIOXIDE		
AGE	D(HC)	R-HC	TOTAL HC	AGE	D(CO)	TOTAL CO	AGE	$D(NO_2)$	TOTAL NO_2
1	1.053	1.307	4.074	1	1.063	7.680	1	1.000	5.698
2	1.145	1.419	4.186	2	1.165	8.417	2	1.000	5.698
3	1.175	1.456	4.223	3	1.210	8.742	3	1.000	5.698
4	1.190	1.474	4.241	4	1.235	8.923	4	1.000	5.698
5	1.195	1.481	4.248	5	1.252	9.046	5	1.000	5.698
6	1.198	1.484	4.251	6	1.263	9.140	6	1.000	5.698
7	1.200	1.487	4.254	7	1.275	9.213	7	1.000	5.698
8	1.200	1.487	4.254	8	1.285	9.284	8	1.000	5.698
9	1.201	1.488	4.255	9	1.292	9.335	9	1.000	5.698
10	1.201	1.488	4.255	10	1.296	9.364	10	1.000	5.698
11	1.202	1.489	4.256	11	1.299	9.385	11	1.000	5.698
12	1.202	1.489	4.256	12	1.301	9.400	12	1.000	5.698
13	1.203	1.491	4.258	13	1.303	9.407	13	1.000	5.698
14	1.203	1.491	4.258	14	1.303	9.414	14	1.000	5.698
15	1.203	1.491	4.258	15	1.304	9.421	15	1.000	5.698
16	1.203	1.491	4.258	16	1.305	9.429	16	1.000	5.698
17	1.203	1.491	4.258	17	1.305	9.429	17	1.000	5.698
18	1.203	1.491	4.258	18	1.305	9.429	18	1.000	5.698
19	1.203	1.491	4.258	19	1.305	9.429	19	1.000	5.698
20	1.203	1.491	4.258	20	1.305	9.429	20	1.000	5.698

R-HC = The total of exhaust and crankcase hydrocarbon emission.

D(HC) = Deterioration factor for HC
D(CO) = Deterioration factor for CO
$D(NO_2)$ = Deterioration factor for NO_2

EMISSIONS FOR RURAL AUTOMOBILES (IN GRAMS/MILE)
YEARS 1971 THROUGH 1976

INPUT	OPERATING CONDITIONS	HC FACTOR	HC VALUE	CO FACTOR	CO VALUE	NO_2 FACTOR	NO_2 VALUE
Input	Calif. Cycle		3.200		23.000		3.757
	Hot Cycle	0.9101	2.003	0.8217	18.899	0.8743	5.033
	Hot 35 Road	0.911	1.824	0.678	12.634	0.8743	4.400
	Hot 45 Road	0.679	1.239	0.413	7.853	1.000	4.400
	Seasonal	1.000	1.239	0.930	7.325	1.305	5.698

HC = Evaporative 0.490 gm/mile
HC = Crankcase None

HYDROCARBONS				CARBON MONOXIDE			NITROGEN DIOXIDE		
AGE	D(HC)	E-HC	TOTAL HC	AGE	D(CO)	TOTAL CO	AGE	$D(NO_2)$	TOTAL NO_2
1	1.054	1.307	1.787	1	1.063	7.680	1	1.000	5.698
2	1.165	1.419	1.909	2	1.165	8.417	2	1.000	5.698
3	1.175	1.436	1.946	3	1.210	8.748	3	1.000	5.698
4	1.190	1.474	1.964	4	1.235	8.923	4	1.000	5.698
5	1.198	1.481	1.971	5	1.252	9.046	5	1.000	5.698
6	1.198	1.484	1.974	6	1.268	9.160	6	1.000	5.698
7	1.200	1.487	1.977	7	1.275	9.213	7	1.000	5.698
8	1.200	1.487	1.977	8	1.285	9.286	8	1.000	5.698
9	1.201	1.488	1.978	9	1.292	9.335	9	1.000	5.698
10	1.201	1.488	1.978	10	1.296	9.364	10	1.000	5.698
11	1.202	1.4n2	1.979	11	1.299	9.385	11	1.000	5.698
12	1.202	1.489	1.979	12	1.301	9.400	12	1.000	5.698
13	1.203	1.491	1.980	13	1.302	9.407	13	1.000	5.698
14	1.203	1.491	1.980	14	1.302	9.416	14	1.000	5.698
15	1.203	1.491	1.980	15	1.302	9.421	15	1.000	5.698
16	1.203	1.491	1.980	16	1.303	9.429	16	1.000	5.698
17	1.203	1.491	1.980	17	1.303	9.429	17	1.000	5.698
18	1.203	1.491	1.980	18	1.303	9.429	18	1.000	5.698
19	1.203	1.491	1.980	19	1.303	9.429	19	1.000	5.698
20	1.203	1.491	1.980	20	1.303	9.429	20	1.000	5.698

E-HC = The total of exhaust and crankcase hydrocarbon emission.

D(HC) = Deterioration factor for HC
D(CO) = Deterioration factor for CO
$D(NO_2)$ = Deterioration factor for NO_2

EMISSIONS FOR RURAL AUTOMOBILES (IN GRAMS/MILE)
YEARS 1975 THROUGH 1990

INPUT	OPERATING CONDITIONS	HC FACTOR	HC VALUE	CO FACTOR	CO VALUE	NO_x FACTOR	NO_x VALUE
Input	Calif. Cycle		0.811		11.300		0.960
	Hot Cycle	0.9101	0.556	0.8217	9.450	0.8743	0.839
	Hot 35 Road	0.911	0.507	0.679	6.416	0.8743	0.734
	Hot 45 Road	0.679	0.344	0.613	3.927	1.000	0.734
	Seasonal	1.000	0.344	0.920	3.613	1.395	0.950

HC = Evaporative None
HC = Crankcase None

HYDROCARBONS				CARBON MONOXIDE			NITROGEN DIOXIDE		
AGE	$\bar{D}$(HC)	X-HC	TOTAL HC	AGE	$\bar{D}$(CO)	TOTAL CO	AGE	$\bar{D}(NO_x)$	TOTAL NO_x
1	1.000	0.363	0.363	1	1.063	3.241	1	1.000	0.950
2	1.143	0.394	0.394	2	1.169	4.209	2	1.000	0.950
3	1.175	0.404	0.404	3	1.210	4.372	3	1.000	0.950
4	1.190	0.409	0.409	4	1.235	4.464	4	1.000	0.950
5	1.195	0.411	0.411	5	1.252	4.523	5	1.000	0.950
6	1.198	0.412	0.412	6	1.261	4.570	6	1.000	0.950
7	1.200	0.413	0.413	7	1.275	4.607	7	1.000	0.950
8	1.200	0.413	0.413	8	1.285	4.643	8	1.000	0.950
9	1.201	0.413	0.413	9	1.292	4.668	9	1.000	0.950
10	1.201	0.413	0.413	10	1.296	4.682	10	1.000	0.950
11	1.202	0.413	0.413	11	1.298	4.693	11	1.000	0.950
12	1.202	0.413	0.413	12	1.301	4.701	12	1.000	0.950
13	1.203	0.414	0.414	13	1.302	4.706	13	1.000	0.950
14	1.203	0.414	0.414	14	1.303	4.708	14	1.000	0.950
15	1.203	0.414	0.414	15	1.304	4.711	15	1.000	0.950
16	1.203	0.414	0.414	16	1.305	4.715	16	1.000	0.950
17	1.203	0.414	0.414	17	1.305	4.715	17	1.000	0.950
18	1.203	0.414	0.414	18	1.305	4.715	18	1.000	0.950
19	1.203	0.414	0.414	19	1.305	4.715	19	1.000	0.950
20	1.203	0.414	0.414	20	1.305	4.715	20	1.000	0.950

X-HC = The total of exhaust and crankcase hydrocarbon emission.

$\bar{D}$(HC) = Deterioration factor for HC
$\bar{D}$(CO) = Deterioration factor for CO
$\bar{D}(NO_x)$ = Deterioration factor for NO_x

EMISSIONS FROM RURAL AUTOMOBILES IN 1960
TOTAL MILEAGE: 299.93 BILLION MILES

AGE	% TOTAL MILES	HC gm/mile	HC billion gm	CO gm/mile	CO billion gm	NO_x gm/mile	NO_x billion gm	MODEL YEAR
1	15.74	9.483	446.74	29.130	1372.20	5.698		1960
2	13.69	10.034	412.00	31.926	1310.89	5.698		1959
3	12.02	10.224	368.59	33.159	1195.43	5.698		1958
4	10.04	10.320	310.77	33.864	1019.14	5.698		1957
5	9.36	10.352	290.62	34.310	963.20	5.698		1956
6	8.18	10.371	254.70	34.666	850.51	5.698		1955
7	7.55	10.384	235.14	34.940	791.21	5.698		1954
8	6.52	10.384	202.06	35.214	688.65	5.698		1953
9	5.24	10.390	163.29	35.406	556.45	5.698		1952
10	4.31	10.390	134.31	35.516	458.11	5.698		1951
11	2.83	10.396	88.34	35.598	302.16	5.698		1950
12	1.74	10.396	54.23	35.653	186.07	5.698		1949
13+	2.78	10.402	86.73	35.680	297.50	5.698		1948
Billion gms			3048.50		9995.50		1709.00	
Million tons			3.360		11.018		1.884	

EMISSIONS FROM RURAL AUTOMOBILES IN 1970
TOTAL MILEAGE: 413.66 BILLION MILES

AGE	% TOTAL MILES	HC gm/mile	HC billion gm	CO gm/mile	CO billion gm	NO_x gm/mile	NO_x billion gm	MODEL YEAR
1	15.74	4.074	265.26	7.680	500.05	5.698		1970
2	13.69	4.977	281.85	12.046	737.47	5.698		1969
3	12.02	5.035	250.35	13.343	663.64	5.698		1968
4	10.04	6.570	272.86	33.844	1405.39	5.698		1967
5	9.36	8.586	255.00	34.310	1338.43	5.698		1966
6	8.18	8.598	233.19	34.666	1173.01	5.698		1965
7	7.55	8.602	206.19	34.940	1091.32	5.698		1964
8	6.52	8.602	178.06	35.214	949.74	5.698		1963
9	5.24	10.390	225.81	35.406	767.45	5.698		1962
10	4.31	10.390	185.24	35.516	633.21	5.698		1961
11	7.83	10.396	121.70	35.598	416.73	5.698		1960
12	1.74	10.396	74.83	35.653	256.62	5.698		1959
13+	2.78	10.402	119.62	35.680	410.31	5.698		1958
Billion gms			2807.74		10323.27		2357.03	
Million tons			3.931		11.379		3.598	

EMISSIONS FROM RURAL AUTOMOBILES IN 1980
TOTAL MILEAGE: 597.88 BILLION MILES

AGE	% TOTAL MILES	HC gm/mile	HC billion gm	CO gm/mile	CO billion gm	NO_x gm/mile	NO_x billion gm	MODEL YEAR
1	15.74	0.363	34.16	3.841	361.46	0.950		1980
2	13.69	0.394	32.25	4.739	364.51	0.950		1979
3	12.02	0.404	29.03	4.372	314.19	0.950		1978
4	10.04	0.405	24.55	4.462	267.84	0.950		1977
5	9.36	0.411	23.00	4.523	253.11	0.950		1976
6	8.18	0.412	20.15	4.570	223.50	0.950		1975
7	7.55	1.977	89.24	9.212	415.83	5.968		1974
8	6.52	1.977	77.07	9.284	361.91	5.968		1973
9	5.24	1.978	61.97	9.335	293.46	5.968		1972
10	4.31	1.978	50.97	9.364	241.30	5.968		1971
11	2.83	4.256	72.01	9.385	158.79	5.968		1970
12	1.74	5.087	52.92	14.346	149.24	5.968		1969
13+	2.78	5.089	84.58	14.357	238.63	5.968		1968
Billion gms			651.90		3623.77		1497.14	
Million tons			0.719		3.993		1.650	

EMISSIONS FROM RURAL AUTOMOBILES IN 1990
TOTAL MILEAGE: 883.67 BILLION MILES

AGE	% TOTAL MILES	HC gm/mile	HC billion gm	CO gm/mile	CO billion gm	NO_x gm/mile	NO_x billion gm	MODEL YEAR
1	15.74	0.363	50.43	3.841	533.64	0.949		1990
2	13.69	0.394	47.61	4.209	508.61	0.949		1989
3	12.02	0.404	43.86	4.373	463.86	0.949		1988
4	10.04	0.409	36.25	4.462	395.62	0.950		1987
5	9.36	0.411	33.96	4.523	373.68	0.950		1986
6	8.18	0.412	29.75	4.570	329.96	0.950		1985
7	7.55	0.413	27.52	4.607	307.03	0.950		1984
8	6.52	0.413	23.77	4.643	267.21	0.950		1983
9	5.24	0.413	19.10	4.668	215.90	0.950		1982
10	4.31	0.413	15.71	4.682	178.12	0.950		1981
11	2.83	0.413	10.32	4.693	117.23	0.950		1980
12	1.74	0.413	6.34	4.701	72.20	0.950		1979
13+	2.78	0.414	10.16	4.704	115.43	0.950		1978
Billion gms			354.78		3878.28		838.54	
Million tons			0.391		4.275		.924	

EMISSIONS FOR RURAL LDT (IN GRAMS/MILE)
YEARS PRECEDING 1963
(UNCONTROLLED)

INPUT	OPERATING CONDITIONS	HC FACTOR	HC VALUE	CO FACTOR	CO VALUE	NO_x FACTOR	NO_x VALUE
Input	Calif. Cycle		5.670		87.234		5.737
	Hot Cycle	0.9101	5.160	0.8217	71.680	0.8743	5.033
	Hot 35 Road	0.911	4.708	0.679	48.671	0.8742	4.400
	Hot 45 Road	0.679	3.196	0.613	39.787	1.000	4.400
	Seasonal	1.063	3.196	0.970	37.404	1.295	5.698

HC = Evaporative 2.767 gm/mile
HC = Crankcase 3.151 gm/mile at 2,000 miles

HYDROCARBONS				CARBON MONOXIDE			NITROGEN DIOXIDE		
AGE	D(HC)	S-HC	TOTAL HC	AGE	D(CO)	TOTAL CO	AGE	$D(NO_x)$	TOTAL NO_x
1	1.065	8.760	9.327	1	1.075	29.459	1	1.000	5.698
2	1.150	7.599	10.066	2	1.170	32.063	2	1.000	5.698
3	1.178	7.477	10.266	3	1.215	33.296	3	1.000	5.698
4	1.192	7.566	10.333	4	1.242	34.036	4	1.000	5.698
5	1.198	7.604	10.371	5	1.257	34.447	5	1.000	5.698
6	1.200	7.616	10.383	6	1.268	34.748	6	1.000	5.698
7	1.200	7.616	10.383	7	1.280	35.077	7	1.000	5.698
8	1.201	7.623	10.390	8	1.288	35.296	8	1.000	5.698
9	1.201	7.623	10.390	9	1.295	35.488	9	1.000	5.698
10	1.202	7.629	10.396	10	1.300	35.625	10	1.000	5.698
11	1.202	7.629	10.396	11	1.302	35.680	11	1.000	5.698
12	1.203	7.635	10.402	12	1.303	35.707	12	1.000	5.698
13	1.203	7.635	10.402	13	1.304	35.734	13	1.000	5.698
14	1.203	7.635	10.402	14	1.305	35.761	14	1.000	5.698
15	1.203	7.635	10.402	15	1.305	35.761	15	1.000	5.698
16	1.203	7.635	10.402	16	1.305	35.761	16	1.000	5.698
17	1.203	7.635	10.402	17	1.305	35.761	17	1.000	5.698
18	1.203	7.635	10.402	18	1.305	35.761	18	1.000	5.698
19	1.203	7.635	10.402	19	1.305	35.761	19	1.000	5.698
20	1.203	7.635	10.402	20	1.305	35.761	20	1.000	5.698

S-HC = The total of exhaust and crankcase hydrocarbon emission.
D(HC) = Deterioration factor for HC
D(CO) = Deterioration factor for CO
$D(NO_x)$ = Deterioration factor for NO_x

EMISSIONS FOR RURAL LDT (IN GRAMS/MILE)
YEARS 1963 THROUGH 1967

INPUT	OPERATING CONDITIONS	HC FACTOR	HC VALUE	CO FACTOR	CO VALUE	NO_2 FACTOR	NO_2 VALUE
Input	Calif. Cycle		5.678		87.234		5.757
	Hot Cycle	0.9101	5.168	0.8217	71.680	0.8743	5.033
	Hot 25 Road	0.911	4.708	0.679	48.671	0.8742	4.400
	Hot 45 Road	0.679	3.196	0.612	39.787	1.000	4.400
	Seasonal	1.000	3.196	0.920	37.404	1.295	5.698

HC = Evaporative 3.767 gm/mile
HC = Crankcase None

HYDROCARBONS				CARBON MONOXIDE			NITROGEN DIOXIDE		
AGE	D(HC)	X-HC	TOTAL HC	AGE	D(CO)	Total CO	AGE	$D(NO_2)$	TOTAL NO_2
1	1.065	3.404	6.171	1	1.075	29.439	1	1.000	5.698
2	1.150	3.675	6.442	2	1.170	32.063	2	1.000	5.698
3	1.178	3.765	6.532	3	1.215	33.296	3	1.000	5.698
4	1.192	3.810	6.577	4	1.242	34.036	4	1.000	5.698
5	1.198	3.829	6.596	5	1.257	34.447	5	1.000	5.698
6	1.200	3.835	6.602	6	1.268	34.748	6	1.000	5.698
7	1.200	3.835	6.602	7	1.280	35.077	7	1.000	5.698
8	1.201	3.838	6.605	8	1.288	35.296	8	1.000	5.698
9	1.201	3.838	6.605	9	1.295	35.488	9	1.000	5.698
10	1.202	3.842	6.609	10	1.300	35.625	10	1.000	5.698
11	1.202	3.842	6.609	11	1.302	35.680	11	1.000	5.698
12	1.203	3.845	6.612	12	1.303	35.707	12	1.000	5.698
13	1.203	3.845	6.612	13	1.304	35.735	13	1.000	5.698
14	1.203	3.845	6.612	14	1.305	35.762	14	1.000	5.698
15	1.203	3.845	6.612	15	1.305	35.762	15	1.000	5.698
16	1.203	3.845	6.612	16	1.305	35.762	16	1.000	5.698
17	1.203	3.845	6.612	17	1.305	35.762	17	1.000	5.698
18	1.203	3.845	6.612	18	1.305	35.762	18	1.000	5.698
19	1.203	3.845	6.612	19	1.305	35.762	19	1.000	5.698
20	1.203	3.845	6.612	20	1.305	35.762	20	1.000	5.698

X-HC = The total of exhaust and crankcase hydrocarbon emission.

D(HC) = Deterioration factor for HC
D(CO) = Deterioration factor for CO
$D(NO_2)$ = Deterioration factor for NO_2

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EMISSIONS FOR RURAL LDT (IN GRAMS/MILE)
YEARS 1968 AND 1969

INPUT	OPERATING CONDITIONS	HC FACTOR	HC VALUE	CO FACTOR	CO VALUE	NO_x FACTOR	NO_x VALUE
Input	Calif. Cycle		3.428		35.103		5.757
	Hot Cycle	0.9101	3.120	0.8317	28.844	0.8743	5.033
	Hot 25 Road	0.911	2.842	0.679	19.585	0.8762	4.400
	Hot 45 Road	0.679	1.930	0.618	11.986	1.000	4.400
	Seasonal	1.000	1.930	0.930	11.037	1.295	5.698

HC = Evaporative 2.767 gm/mile
HC = Crankcase None

HYDROCARBONS				CARBON MONOXIDE			NITROGEN DIOXIDE		
AGE	$\bar{D}$(HC)	E-HC	TOTAL HC	AGE	$\bar{D}$(CO)	TOTAL CO	AGE	$\bar{D}(NO_x)$	TOTAL NO_x
1	1.065	2.055	4.822	1	1.075	11.854	1	1.000	5.698
2	1.150	2.220	4.987	2	1.170	12.902	2	1.000	5.698
3	1.178	2.274	5.041	3	1.215	13.398	3	1.000	5.698
4	1.192	2.301	5.068	4	1.242	13.696	4	1.000	5.698
5	1.198	2.312	5.079	5	1.257	13.861	5	1.000	5.698
6	1.200	2.316	5.083	6	1.268	13.982	6	1.000	5.698
7	1.200	2.316	5.083	7	1.280	14.115	7	1.000	5.698
8	1.201	2.318	5.085	8	1.288	14.203	8	1.000	5.698
9	1.201	2.318	5.085	9	1.295	14.280	9	1.000	5.698
10	1.202	2.320	5.087	10	1.300	14.335	10	1.000	5.698
11	1.202	2.320	5.087	11	1.302	14.357	11	1.000	5.698
12	1.203	2.322	5.089	12	1.303	14.368	12	1.000	5.698
13	1.203	2.322	5.089	13	1.304	14.379	13	1.000	5.698
14	1.203	2.322	5.089	14	1.305	14.390	14	1.000	5.698
15	1.203	2.322	5.089	15	1.305	14.390	15	1.000	5.698
16	1.203	2.322	5.089	16	1.305	14.390	16	1.000	5.698
17	1.203	2.322	5.089	17	1.305	14.390	17	1.000	5.698
18	1.203	2.322	5.089	18	1.305	14.390	18	1.000	5.698
19	1.203	2.322	5.089	19	1.305	14.390	19	1.000	5.698
20	1.203	2.322	5.089	20	1.305	14.390	20	1.000	5.698

E-HC = The total of exhaust and crankcase hydrocarbon emission.

$\bar{D}$(HC) = Deterioration factor for HC
$\bar{D}$(CO) = Deterioration factor for CO
$\bar{D}(NO_x)$ = Deterioration factor for NO_x

EMISSIONS FOR RURAL LDT (IN GRAMS/MILE)
YEAR 1970

INPUT	OPERATING CONDITIONS	HC FACTOR	HC VALUE	CO FACTOR	CO VALUE	NO_x FACTOR	NO_x VALUE
Input	Calif. Cycle		2.200		33.000		5.757
	Hot Cycle	0.9101	2.002	0.6217	18.899	0.8743	5.033
	Hot 25 Road	0.911	1.824	0.679	12.832	0.8743	4.400
	Hot 45 Road	0.679	1.239	0.613	7.053	1.000	4.400
	Seasonal	1.000	1.239	0.930	7.335	1.295	5.698

HC = Evaporative 3.767 gm/mile
HC = Crankcase None

HYDROCARBONS				CARBON MONOXIDE			NITROGEN DIOXIDE		
AGE	$\bar{D}$(HC)	R-HC	TOTAL HC	AGE	$\bar{D}$(CO)	TOTAL CO	AGE	$\bar{D}(NO_x)$	TOTAL NO_x
1	1.065	1.320	4.087	1	1.075	7.767	1	1.000	5.698
2	1.150	1.425	4.192	2	1.170	8.453	2	1.000	5.698
3	1.178	1.460	4.227	3	1.215	8.778	3	1.000	5.698
4	1.192	1.477	4.244	4	1.242	8.973	4	1.000	5.698
5	1.198	1.484	4.251	5	1.257	9.082	5	1.000	5.698
6	1.200	1.487	4.254	6	1.268	9.161	6	1.000	5.698
7	1.200	1.487	4.254	7	1.270	9.248	7	1.000	5.698
8	1.201	1.488	4.255	8	1.288	9.306	8	1.000	5.698
9	1.201	1.488	4.255	9	1.295	9.356	9	1.000	5.698
10	1.202	1.489	4.256	10	1.300	9.393	10	1.000	5.698
11	1.202	1.489	4.256	11	1.302	9.407	11	1.000	5.698
12	1.203	1.491	4.258	12	1.303	9.414	12	1.000	5.698
13	1.203	1.491	4.258	13	1.304	9.421	13	1.000	5.698
14	1.203	1.491	4.259	14	1.305	9.429	14	1.000	5.698
15	1.203	1.491	4.258	15	1.305	9.429	15	1.000	5.698
16	1.203	1.491	4.258	16	1.305	9.429	16	1.000	5.698
17	1.203	1.491	4.258	17	1.305	9.429	17	1.000	5.698
18	1.203	1.491	4.258	18	1.305	9.429	18	1.000	5.698
19	1.203	1.491	4.258	19	1.305	9.429	19	1.000	5.698
20	1.203	1.491	4.258	20	1.305	9.429	20	1.000	5.698

R-HC = The total of exhaust and crankcase hydrocarbon emission.

$\bar{D}$(HC) = Deterioration factor for HC
$\bar{D}$(CO) = Deterioration factor for CO
$\bar{D}(NO_x)$ = Deterioration factor for NO_x

EMISSIONS FOR RURAL LDT (IN GRAMS/MILE)
YEARS 1971 THROUGH 1974

INPUT	OPERATING CONDITIONS	HC FACTOR	HC VALUE	CO FACTOR	CO VALUE	NO_x FACTOR	NO_x VALUE
Input	Calif. Cycle		3.200		33.000		5.757
	Hot Cycle	0.9101	2.002	0.8217	18.899	0.8743	5.033
	Hot 35 Road	0.911	1.824	0.679	12.832	0.8742	4.400
	Hot 45 Road	0.679	1.239	0.613	7.853	1.000	4.400
	Seasonal	1.000	1.239	0.920	7.225	1.295	5.698

HC = Evaporative 0.490 gm/mile
HC = Crankcase None

HYDROCARBONS				CARBON MONOXIDE			NITROGEN DIOXIDE		
AGE	D(HC)	E-HC	TOTAL HC	AGE	D(CO)	TOTAL CO	AGE	$D(NO_x)$	TOTAL NO_x
1	1.065	1.320	1.810	1	1.079	7.767	1	1.000	5.698
2	1.150	1.425	1.915	2	1.170	8.453	2	1.000	5.698
3	1.178	1.460	1.950	3	1.215	8.778	3	1.000	5.698
4	1.192	1.477	1.967	4	1.242	8.973	4	1.000	5.698
5	1.198	1.482	1.974	5	1.257	9.082	5	1.000	5.698
6	1.200	1.487	1.977	6	1.268	9.161	6	1.000	5.698
7	1.200	1.487	1.977	7	1.280	9.248	7	1.000	5.698
8	1.201	1.488	1.978	8	1.288	9.306	8	1.000	5.698
9	1.201	1.488	1.978	9	1.295	9.356	9	1.000	5.698
10	1.202	1.489	1.979	10	1.300	9.392	10	1.000	5.698
11	1.202	1.489	1.979	11	1.302	9.407	11	1.000	5.698
12	1.203	1.491	1.981	12	1.303	9.414	12	1.000	5.698
13	1.203	1.491	1.981	13	1.304	9.421	13	1.000	5.698
14	1.203	1.491	1.981	14	1.305	9.429	14	1.000	5.698
15	1.203	1.491	1.981	15	1.305	9.429	15	1.000	5.698
16	1.203	1.491	1.981	16	1.305	9.429	16	1.000	5.698
17	1.203	1.491	1.981	17	1.305	9.429	17	1.000	5.698
18	1.203	1.491	1.981	18	1.305	9.429	18	1.000	5.698
19	1.203	1.491	1.981	19	1.305	9.429	19	1.000	5.698
20	1.203	1.491	1.981	20	1.305	9.429	20	1.000	5.698

E-HC = The total of exhaust and crankcase hydrocarbon emission.

D(HC) = Deterioration factor for HC
D(CO) = Deterioration factor for CO
$D(NO_x)$ = Deterioration factor for NO_x

EMISSIONS FOR RURAL LDT (IN GRAMS/MILE)
YEARS 1975 THROUGH 1990

INPUT	OPERATING CONDITIONS	HC FACTOR	HC VALUE	CO FACTOR	CO VALUE	NO_x FACTOR	NO_x VALUE
Input	Calif. Cycle		0.611		11.300		0.960
	Hot Cycle	0.9101	0.556	0.8217	9.450	0.8743	0.839
	Hot 35 Road	0.911	0.507	0.679	6.416	0.8762	0.734
	Hot 45 Road	0.679	0.344	0.613	3.927	1.000	0.734
	Seasonal	1.000	0.344	0.930	3.613	1.295	0.950

HC = Evaporative None
HC = Crankcase None

	HYDROCARBONS				CARBON MONOXIDE			NITROGEN DIOXIDE		
AGE	D(HC)	R-HC	TOTAL HC	AGE	D(CO)	TOTAL CO	AGE	$D(NO_x)$	TOTAL NO_x
1	1.065	0.366	0.366	1	1.075	3.884	1	1.000	0.950
2	1.150	0.396	0.396	2	1.170	4.227	2	1.000	0.950
3	1.178	0.405	0.405	3	1.215	4.390	3	1.000	0.950
4	1.192	0.410	0.410	4	1.242	4.487	4	1.000	0.950
5	1.198	0.412	0.412	5	1.257	4.542	5	1.000	0.950
6	1.200	0.413	0.413	6	1.268	4.581	6	1.000	0.950
7	1.200	0.413	0.413	7	1.280	4.625	7	1.000	0.950
8	1.201	0.413	0.413	8	1.288	4.654	8	1.000	0.950
9	1.201	0.413	0.413	9	1.295	4.679	9	1.000	0.950
10	1.203	0.413	0.413	10	1.300	4.697	10	1.000	0.950
11	1.203	0.413	0.413	11	1.303	4.704	11	1.000	0.950
12	1.203	0.414	0.414	12	1.303	4.708	12	1.000	0.950
13	1.203	0.414	0.414	13	1.306	4.711	13	1.000	0.950
14	1.203	0.414	0.414	14	1.305	4.715	14	1.000	0.950
15	1.203	0.414	0.414	15	1.305	4.715	15	1.000	0.950
16	1.203	0.414	0.414	16	1.305	4.715	16	1.000	0.950
17	1.203	0.414	0.414	17	1.305	4.715	17	1.000	0.950
18	1.203	0.414	0.414	18	1.305	4.715	18	1.000	0.950
19	1.203	0.414	0.414	19	1.305	4.715	19	1.000	0.950
20	1.203	0.414	0.414	20	1.305	4.715	20	1.000	0.950

R-HC = The total of exhaust and crankcase hydrocarbon emission.

D(HC) = Deterioration factor for HC
D(CO) = Deterioration factor for CO
$D(NO_x)$ = Deterioration factor for NO_x

EMISSIONS FROM RURAL LIGHT DUTY TRUCKS IN 1960
TOTAL MILEAGE: 35.39 BILLION MILES

AGE	% TOTAL MILES	HC gm/mile	HC billion gm	CO gm/mile	CO billion gm	NO_x gm/mile	NO_x billion gm	MODEL YEAR
1	10.0	9.527	33.72	29.459	104.26	5.698		1960
2	9.5	10.066	33.84	32.063	107.80	5.698		1959
3	9.0	10.344	32.63	33.296	105.05	5.698		1958
4	8.5	10.333	31.08	34.036	102.39	5.698		1957
5	8.0	10.371	29.36	34.447	97.53	5.698		1956
6	7.5	10.383	27.56	34.748	92.23	5.698		1955
7	7.0	10.383	25.72	35.077	86.90	5.698		1954
8	6.5	10.390	23.90	35.296	81.19	5.698		1953
9	6.0	10.390	22.06	35.488	75.36	5.698		1952
10	5.5	10.396	20.24	35.625	69.45	5.698		1951
11	5.0	10.396	18.40	35.680	63.18	5.698		1950
12	4.5	10.402	16.57	35.707	56.87	5.698		1949
13	4.0	10.402	14.73	35.735	50.59	5.698		1948
14	3.5	10.402	12.88	35.762	44.30	5.698		1947
15	3.0	10.402	11.04	35.762	37.97	5.698		1946
16	2.5	10.402	9.20	35.762	31.64	5.698		1945
Billion gms			362.93		1207.71		201.65	
Million tons			0.400		1.331		0.222	

EMISSIONS FROM RURAL LIGHT DUTY TRUCKS IN 1970
TOTAL MILEAGE: 56.53 BILLION MILES

AGE	% TOTAL MILES	HC gm/mile	HC billion gm	CO gm/mile	CO billion gm	NO_x gm/mile	NO_x billion gm	MODEL YEAR
1	10.0	4.087	23.10	7.767	43.91	5.698		1970
2	9.5	4.987	26.78	12.903	69.29	5.698		1969
3	9.0	5.041	25.65	13.398	68.17	5.698		1968
4	8.5	6.577	31.60	34.036	163.54	5.698		1967
5	8.0	8.596	29.83	34.447	155.78	5.698		1966
6	7.5	8.603	27.92	34.748	147.32	5.698		1965
7	7.0	8.603	26.12	35.077	138.80	5.698		1964
8	6.5	8.605	24.27	35.296	129.69	5.698		1963
9	6.0	10.390	25.24	35.488	120.37	5.698		1962
10	5.5	10.396	23.32	35.625	110.76	5.698		1961
11	5.0	10.396	29.38	35.680	100.85	5.698		1960
12	4.5	10.502	26.46	35.707	90.83	5.698		1959
13	4.0	10.402	23.52	35.735	80.80	5.698		1958
14	3.5	10.402	20.58	35.762	70.76	5.698		1957
15	3.0	10.402	17.64	35.762	60.65	5.698		1956
16	2.5	10.402	14.70	35.762	50.54	5.698		1955
Billion gms			415.10		1402.06		322.11	
Million tons			0.458		1.766		0.355	

EMISSIONS FROM RURAL LIGHT DUTY TRUCKS IN 1980
TOTAL MILEAGE: 90.43 BILLION MILES

AGE	% TOTAL MILES	HC gm/mile	HC billion gm	CO gm/mile	CO billion gm	NO_2 gm/mile	NO_2 billion gm	MODEL YEAR
1	10.0	0.366	3.31	3.884	35.12	0.950		1980
2	9.5	0.396	3.40	4.227	36.31	0.950		1979
3	9.0	0.405	3.30	4.390	35.73	0.950		1978
4	8.5	0.410	3.15	4.487	34.49	0.950		1977
5	8.0	0.412	2.98	4.542	32.86	0.950		1976
6	7.5	0.413	2.80	4.581	31.07	0.950		1975
7	7.0	1.977	12.51	9.248	58.54	5.698		1974
8	6.5	1.978	11.65	9.306	54.70	5.698		1973
9	6.0	1.978	10.73	9.336	50.70	5.698		1972
10	5.5	1.978	9.84	9.362	46.71	5.698		1971
11	5.0	4.256	19.24	9.407	42.53	5.698		1970
12	4.5	5.089	20.71	14.368	58.47	5.698		1969
13	4.0	5.089	18.41	14.379	51.01	5.698		1968
14	3.5	6.612	20.93	35.762	113.19	5.698		1967
15	3.0	6.612	17.94	35.762	97.02	5.698		1966
16	2.5	6.612	14.93	35.762	80.85	5.698		1965
Billion gms			175.83		860.36		389.86	
Million tons			0.194		0.948		0.330	

EMISSIONS FROM RURAL LIGHT DUTY TRUCKS IN 1990
TOTAL MILEAGE: 145.33 BILLION MILES

AGE	% TOTAL MILES	HC gm/mile	HC billion gm	CO gm/mile	CO billion gm	NO_2 gm/mile	NO_2 billion gm	MODEL YEAR
1	10.0	0.366	5.32	3.884	56.45	0.950		1990
2	9.5	0.396	5.47	4.227	58.36	0.950		1989
3	9.0	0.405	5.30	4.390	57.48	0.950		1988
4	8.5	0.410	5.06	4.487	55.43	0.950		1987
5	8.0	0.412	4.79	4.542	52.81	0.950		1986
6	7.5	0.413	4.50	4.581	49.93	0.950		1985
7	7.0	0.413	4.20	4.625	47.05	0.950		1984
8	6.5	0.413	3.90	4.654	43.96	0.950		1983
9	6.0	0.413	3.60	4.679	40.80	0.950		1982
10	5.5	0.413	3.30	4.697	37.54	0.950		1981
11	5.0	0.413	3.00	4.704	34.18	0.950		1980
12	4.5	0.414	2.71	4.708	30.79	0.950		1979
13	4.0	0.414	2.41	4.711	27.39	0.950		1978
14	3.5	0.414	2.11	4.713	23.98	0.950		1977
15	3.0	0.414	1.80	4.715	20.56	0.950		1976
16	2.5	0.414	1.50	4.715	17.13	0.950		1975
Billion gms			59.87		613.78		138.06	
Million tons			0.066		0.761		0.152	

5. COMPUTER PRINTOUT FOR YEARS 1966 THROUGH 1990

The method has been programmed by Ken Goodman and Clyde Harris, using their predictions of total vehicular travel and travel distribution among vehicle categories.

5.1 SUMMARY OF COMPUTER PRINTOUT FOR ESTIMATED NATIONAL YEARLY EMISSIONS BASED ON HIGH PROJECTION OF VEHICULAR MILEAGES

YEAR	HYDROCARBON MILLIONS OF TONS URBAN	RURAL	TOTAL	CARBON MONOXIDE MILLIONS OF TONS URBAN	RURAL	TOTAL	NITROGEN DIOXIDE MILLIONS OF TONS URBAN	RURAL	TOTAL
1960	8.989	8.182	11.131	33.440	13.779	91.219	2.221	2.778	4.999
1961	6.158	8.260	11.418	36.593	16.079	52.672	2.293	2.831	5.124
1962	6.441	5.437	11.878	38.292	16.617	54.909	2.400	2.926	5.326
1963	6.623	5.535	12.158	40.548	17.635	58.183	2.544	3.114	5.658
1964	6.766	5.617	12.383	42.882	18.445	61.327	2.690	3.258	5.948
1965	6.868	5.460	12.283	44.990	19.130	64.120	2.822	3.379	6.201
1966	7.003	5.401	12.404	47.353	19.806	67.159	2.969	3.497	6.466
1967	7.101	5.325	12.426	49.463	20.399	69.862	3.101	3.600	6.701
1968	7.006	5.176	12.182	47.746	19.434	67.180	3.253	3.735	6.989
1969	6.913	5.032	11.945	45.329	19.839	65.168	3.415	3.878	7.293
1970	6.693	4.829	11.522	44.772	17.700	61.472	3.586	4.028	7.614
1971	6.295	4.353	10.748	41.429	16.849	58.078	3.769	4.186	7.955
1972	5.922	4.104	10.026	39.038	15.602	54.640	3.963	4.352	8.315
1973	5.603	3.800	9.403	36.939	14.636	51.475	4.169	4.528	8.697
1974	5.321	3.533	8.854	34.609	13.680	48.289	4.388	4.713	9.101
				(With Controls in 1975)					
1975	4.719	3.084	7.803	31.382	12.363	43.685	4.059	4.351	8.410
1976	4.199	2.706	6.905	28.247	11.131	39.378	3.755	4.016	7.771
1977	3.698	2.345	6.043	25.401	9.991	35.392	3.469	3.702	7.171
1978	3.260	2.020	5.280	23.189	9.059	32.248	3.218	3.422	6.640
1979	2.982	1.764	4.846	21.411	8.272	29.683	2.961	3.143	6.104
1980	2.906	1.918	4.024	19.222	7.388	26.610	2.719	2.881	5.600
1981	2.239	1.325	3.564	16.681	6.931	23.612	2.474	2.622	5.096
1982	1.986	1.148	3.132	17.681	6.472	24.153	2.246	2.380	4.626
1983	1.769	0.982	2.753	17.377	6.167	23.544	2.051	2.169	4.220
1984	1.659	0.892	2.551	17.489	6.104	23.593	1.882	1.980	3.862
1985	1.589	0.822	2.411	17.808	6.100	23.908	1.774	1.840	3.613
1986	1.565	0.780	2.345	18.380	6.196	24.576	1.713	1.738	3.451
1987	1.513	0.738	2.251	18.810	6.256	25.066	1.587	1.593	3.180
1988	1.559	0.736	2.295	19.725	6.439	26.164	1.626	1.566	3.190
1989	1.611	0.737	2.348	20.703	6.637	27.340	1.668	1.546	3.214
1990	1.670	0.743	2.413	21.746	6.853	28.598	1.720	1.535	3.255

SUMMARY OF COMPUTER PRINTOUT FOR ESTIMATED NATIONAL YEARLY EMISSIONS
BASED ON HIGH PROJECTION OF VEHICULAR MILEAGES
NO CONTROLS IN 1975

YEAR	HYDROCARBON MILLIONS OF TONS URBAN	RURAL	TOTAL	CARBON MONOXIDE MILLIONS OF TONS URBAN	RURAL	TOTAL	NITROGEN DIOXIDE MILLIONS OF TONS URBAN	RURAL	TOTAL
1975	5.038	3.255	8.293	32.563	12.801	45.364	4.621	4.908	9.529
1976	4.830	3.053	7.883	30.816	12.031	42.847	4.869	5.113	9.982
1977	4.658	2.867	7.525	29.336	11.359	40.695	5.132	5.329	10.461
1978	4.539	2.711	7.250	28.463	10.880	39.343	5.411	5.555	10.966
1979	4.497	2.628	7.125	28.097	10.561	38.658	5.706	5.793	11.499
1980	4.458	2.554	7.012	27.333	10.163	37.678	6.020	6.043	12.062
1981	4.549	2.536	7.078	28.086	10.161	38.247	6.352	6.303	12.655
1982	4.639	2.537	7.172	28.788	10.175	38.963	6.704	6.576	13.280
1983	4.769	2.534	7.303	29.952	10.324	40.276	7.076	6.861	13.937
1984	5.003	2.609	7.611	31.523	10.706	42.229	7.470	7.158	14.628
1985	5.252	2.691	7.943	33.195	11.112	44.307	7.885	7.469	15.354
1986	5.533	2.793	8.326	35.044	11.591	46.635	8.324	7.792	16.116
1987	5.839	2.915	8.754	36.996	12.020	49.016	8.787	8.129	16.916
1988	6.161	3.041	9.202	39.049	12.608	51.657	9.274	8.479	17.753
1989	6.500	3.172	9.672	41.215	13.146	54.361	9.788	8.842	18.630
1990	6.856	3.309	10.165	43.493	13.705	57.198	10.328	9.219	19.547

5.3 Computer Printout

The computer printout is by year, and contains the following for each vehicle type and class: total vehicular mileage during the year; and total estimated emissions for the year of hydrocarbons, carbon monoxide, and nitrogen dioxide.

YEAR 1960

-VEHICLE MILES IN BILLIONS-

	AUTO	LDT	HDT CLASS-2	HDT CLASS-3	HDT CLASS-4
URBAN	288.16	23.59	6.59	4.39	8.26
RURAL	297.93	35.37	9.88	6.59	20.24
TOTAL	586.10	58.99	16.48	10.98	28.51

MILLION TONS/YEAR

	HC		CO		NOX	
	URBAN	RURAL	URBAN	RURAL	URBAN	RURAL
AUTO	4.514	3.359	26.368	11.014	1.760	1.883
LDT	0.373	0.399	2.379	1.330	0.144	0.222
HDT CL-2	0.307	0.308	1.258	0.703	0.099	0.083
HDT CL-3	0.258	0.257	1.091	0.610	0.079	0.114
HDT CL-4	0.915	0.837	3.942	2.120	0.189	0.476
TOTAL	5.969	5.168	35.440	15.779	2.321	2.778

YEAR 1981

-VEHICLE MILES IN BILLIONS-

	AUTO	LDT	HDT CLASS-2	HDT CLASS-3	CLASS-4
URBAN	398.67	23.99	6.70	4.46	8.48
RURAL	365.93	35.98	10.05	6.70	20.58
TOTAL	804.60	59.98	16.75	11.17	28.99

MILLION TONS / YEAR

	HC		CO		NOX	
	URBAN	RURAL	URBAN	RURAL	URBAN	RURAL
AUTO	4.679	3.426	29.422	11.235	1.824	1.920
LDT	0.979	0.606	2.619	1.355	0.146	0.229
HDT CL-2	0.312	0.319	1.879	0.719	0.054	0.084
HDT CL-3	0.268	0.261	1.109	0.620	0.079	0.115
HDT CL-4	0.524	0.535	3.361	3.195	0.192	0.484
TOTAL	6.158	5.260	38.593	16.879	2.293	2.831

YEAR 1982

-VEHICLE MILES IN BILLIONS-

	AUTO	LDT	HDT CLASS-2	HDT CLASS-3	HDT CLASS-4
URBAN	519.29	34.45	6.94	4.63	8.71
RURAL	315.80	27.68	10.41	6.94	21.32
TOTAL	835.10	62.14	17.36	11.57	30.04

MILLION TONS/YEAR

	HC		CO		NOX	
	URBAN	RURAL	URBAN	RURAL	URBAN	RURAL
AUTO	4.908	3.537	30.863	11.898	1.914	1.983
LDT	0.393	0.421	2.607	1.402	0.191	0.234
HDT CL-2	0.323	0.329	1.328	0.741	0.086	0.087
HDT CL-3	0.272	0.171	1.149	0.642	0.077	0.120
HDT CL-4	0.543	0.882	2.447	2.233	0.199	0.501
TOTAL	6.441	5.437	38.293	16.917	2.469	2.926

YEAR 1969

-VEHICLE MILES IN BILLIONS-

	AUTO	LDT	HDT CLASS-2	HDT CLASS-3	HDT CLASS-4
URBAN	323.99	28.68	8.86	5.37	10.12
RURAL	221.48	43.92	12.10	8.06	24.78
TOTAL	545.48	72.60	20.17	13.44	34.90

MILLION TONS/YEAR

	HC		CO		NOX	
	URBAN	RURAL	URBAN	RURAL	URBAN	RURAL
AUTO	4.889	3.414	31.917	11.803	1.979	2.018
LDT	0.446	0.473	2.913	1.628	0.176	0.272
HDT CL-2	0.366	0.362	1.940	0.861	0.086	0.101
HDT CL-3	0.307	0.302	1.355	0.746	0.090	0.137
HDT CL-4	0.614	0.982	2.843	2.594	0.231	0.582
TOTAL	6.623	5.535	40.948	17.635	2.564	3.114

YEAR 1964

-VEHICLE MILES IN BILLIONS-

	AUTO	LDT	HDT CLASS=2	HDT CLASS=3	HDT CLASS=4
URBAN	342.86	30.46	8.91	5.67	10.67
RURAL	334.73	45.70	12.76	8.51	26.14
TOTAL	677.60	76.17	21.28	14.18	36.82

MILLION TONS/YEAR

	HC		CO		NOX	
	URBAN	RURAL	URBAN	RURAL	URBAN	RURAL
AUTO	4.987	3.379	35.776	12.293	2.094	2.101
LDT	0.459	0.482	3.073	1.718	0.186	0.286
HDT CL=2	0.375	0.365	1.624	0.908	0.069	0.107
HDT CL=3	0.315	0.304	1.408	0.787	0.095	0.147
HDT CL>4	0.628	0.990	2.999	2.737	0.244	0.614
TOTAL	6.766	5.517	42.882	18.445	2.699	3.758

YEAR 1985

=VEHICLE MILES IN MILLIONS=

	AUTO	LDT	HDT CLASS=2	HDT CLASS=3	HDT CLASS=6
URBAN	360.26	31.78	8.88	5.92	11.13
RURAL	346.13	47.67	13.32	8.88	27.27
TOTAL	706.40	79.46	22.20	14.80	38.41

MILLION TONS/YEAR

	HC		CO		NOX	
	URBAN	RURAL	URBAN	RURAL	URBAN	RURAL
AUTO	5.063	3.319	35.490	12.711	2.201	2.173
LDT	0.467	0.485	3.206	1.792	0.196	0.299
HDT CL=2	0.380	0.365	1.695	0.947	0.072	0.112
HDT CL=3	0.319	0.303	1.465	0.821	0.099	0.153
HDT CL=6	0.637	0.987	3.129	2.855	0.254	0.441
TOTAL	6.868	5.460	44.990	19.130	2.822	3.179

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YEAR 1966

=VEHICLE MILES IN BILLIONS=

	AUTO	LDT	HDT CLASS=2	HDT CLASS=3	HDT CLASS=4
URBAN	282.82	32.85	9.01	6.00	13.30
RURAL	361.97	48.38	13.51	9.01	27.67
TOTAL	744.80	80.63	22.52	15.01	38.97

MILLION TONS/YEAR

	HC		CO		NOX	
	URBAN	RURAL	URBAN	RURAL	URBAN	RURAL
AUTO	5.222	3.320	37.713	18.293	2.338	2.272
LDT	0.462	0.478	3.253	1.819	0.197	0.303
HDT CL=2	0.375	0.384	1.710	0.961	0.075	0.113
HDT CL=3	0.314	0.294	1.491	0.833	0.101	0.155
HDT CL=4	0.628	0.986	3.175	2.898	0.258	0.680
TOTAL	7.003	5.401	47.333	19.804	2.969	3.497

YEAR 1967

-VEHICLE MILES IN BILLIONS-

	AUTO	LDT	HDT CLASS=2	HDT CLASS=3	HDT CLASS=4
URBAN	402.02	32.98	9.21	6.14	11.55
RURAL	374.08	49.47	13.82	9.21	28.30
TOTAL	776.11	82.46	23.03	15.35	39.86

MILLION TONS/YEAR

	HC		CO		NOX	
	URBAN	RURAL	URBAN	RURAL	URBAN	RURAL
AUTO	5.328	3.286	39.604	15.738	2.406	2.348
LDT	0.462	0.469	3.317	1.860	0.201	0.310
HDT CL=2	0.373	0.346	1.759	0.983	0.075	0.116
HDT CL=3	0.312	0.287	1.525	0.852	0.103	0.159
HDT CL=4	0.624	0.934	3.247	2.963	0.264	0.665
TOTAL	7.101	5.325	49.463	20.799	3.101	3.600

YEAR 1968

=VEHICLE MILES IN BILLIONS=

	AUTO	LDT	HDT CLASS=2	HDT CLASS=3	HDT CLASS=4
URBAN	452.22	34.46	9.62	6.41	12.07
RURAL	356.63	51.69	14.44	9.62	29.57
TOTAL	808.85	86.16	24.07	16.04	41.65

MILLION TONS/YEAR

	HC		CO		NOX	
	URBAN	RURAL	URBAN	RURAL	URBAN	RURAL
AUTO	5.247	3.175	38.174	19.031	2.579	2.427
LDT	0.461	0.467	3.296	1.843	0.210	0.324
HDT CL=2	0.369	0.339	1.743	0.975	0.078	0.134
HDT CL=3	0.309	0.281	1.512	0.845	0.108	0.166
HDT CL=4	0.617	0.913	3.219	2.938	0.276	0.695
TOTAL	7.006	5.175	47.946	19.634	3.253	3.725

YEAR 1969

-VEHICLE MILES IN BILLIONS-

	AUTO	LDT	HDT CLASS=2	HDT CLASS=3	CLASS=4
URBAN	443.67	36.03	10.06	6.71	18.62
RURAL	399.80	54.05	15.10	10.06	30.91
TOTAL	843.48	90.08	25.16	16.77	49.54

MILLION TONS/YEAR

	HC		CO		NOX	
	URBAN	RURAL	URBAN	RURAL	URBAN	RURAL
AUTO	5.171	3.970	36.687	12.324	2.710	2.510
LDT	0.460	0.464	3.252	1.119	0.220	0.339
HDT CL=2	0.365	0.331	1.720	0.962	0.082	0.127
HDT CL=3	0.305	0.274	1.491	0.834	0.112	0.174
HDT CL=4	0.639	0.890	3.178	2.899	0.288	0.727
TOTAL	6.913	5.032	46.329	18.859	3.413	3.878

YEAR 1970

=VEHICLE MILES IN BILLIONS=

	AUTO	LDT	HDT CLASS=2	HDT CLASS=3	CLASS=4
URBAN	466.47	37.69	10.93	7.08	14.20
RURAL	413.66	56.53	15.79	10.[illegible]	32.33
TOTAL	880.14	94.23	26.32	17.95	46.54

MILLION TONS/YEAR

	HC		CO		NOX	
	URBAN	RURAL	URBAN	RURAL	URBAN	RURAL
AUTO	4.995	2.930	34.413	11.976	2.849	2.597
LDT	0.453	0.457	3.157	1.765	0.230	0.355
HDT CL=2	0.355	0.320	1.670	0.934	0.086	0.[illegible]2
HDT CL=3	0.296	0.264	1.448	0.809	0.118	0.182
HDT CL=4	0.592	0.856	3.083	2.814	0.302	0.760
TOTAL	6.693	4.829	43.772	17.700	3.586	4.0[illegible]

YEAR 1971

-VEHICLE MILES IN BILLIONS-

	AUTO	LDT	HDT CLASS=2	HDT CLASS=3	HDT CLASS=4
URBAN	490.73	39.44	11.02	7.34	19.82
RURAL	428.24	59.17	16.83	11.02	33.84
TOTAL	918.97	98.61	27.85	18.36	47.66

MILLION TONS/YEAR

	HC		CO		NOX	
	URBAN	RURAL	URBAN	RURAL	URBAN	RURAL
AUTO	4.661	2.648	32.876	10.552	2.998	2.669
LDT	0.436	0.435	3.053	1.707	0.341	0.371
HDT CL=2	0.342	0.304	1.615	0.903	0.093	0.139
HDT CL=3	0.285	0.290	1.401	0.783	0.123	0.190
HDT CL=4	0.570	0.813	2.982	2.722	0.316	0.795
TOTAL	6.295	4.488	41.429	16.649	3.769	4.166

YEAR 1972

=VEHICLE MILES IN BILLIONS=

	AUTO	LDT	HDT CLASS=2	HDT CLASS=3	HDT CLASS=4
URBAN	816.55	41.30	11.83	7.69	14.47
RURAL	443.56	61.95	17.30	11.54	35.43
TOTAL	960.13	103.25	28.84	19.23	49.91

MILLION TONS/YEAR

	HC		CO		NOX	
	URBAN	RURAL	URBAN	RURAL	URBAN	RURAL
AUTO	4.351	2.396	30.305	9.701	3.155	2.785
LDT	0.419	0.414	2.945	1.647	0.252	0.389
HDT CL=2	0.328	0.288	1.958	0.871	0.094	0.145
HDT CL=3	0.274	0.237	1.351	0.755	0.129	0.199
HDT CL=4	0.947	0.770	2.877	2.626	0.331	0.833
TOTAL	6.922	4.104	39.036	15.602	3.963	4.352

YEAR 1973

"VEHICLE MILES IN BILLIONS"

	AUTO	LDT	HDT CLASS=2	HDT CLASS=3	HDT CLASS=4
URBAN	944.04	49.26	10.08	8.05	15.16
RURAL	459.72	64.89	10.13	12.08	37.11
TOTAL	1003.76	108.15	20.21	20.14	52.28

MILLION TONS/YEAR

	HC		CO		NOX	
	URBAN	RURAL	URBAN	RURAL	URBAN	RURAL
AUTO	4.095	2.184	28.434	8.957	3.323	2.886
LDT	0.402	0.392	2.834	1.585	0.264	0.407
HDT CL=2	0.315	0.272	1.500	0.838	0.098	0.152
HDT CL=3	0.263	0.224	1.300	0.727	0.135	0.209
HDT CL=4	0.525	0.727	2.769	2.527	0.346	0.872
TOTAL	5.603	3.800	36.839	14.636	4.169	4.528

YEAR 1974

=VEHICLE MILES IN BILLIONS=

	AUTO	LDT	HDT CLASS=2	HDT CLASS=3	HDT CLASS=4
URBAN	573.50	48.33	12.66	8.44	18.88
RURAL	476.70	67.99	18.99	12.66	38.89
TOTAL	1050.00	116.33	31.66	21.10	54.78

MILLION TONS/YEAR

	HC		CO		NOX	
	URBAN	RURAL	URBAN	RURAL	URBAN	RURAL
AUTO	3.876	2.009	26.537	8.225	3.502	2.993
LDT	0.385	0.371	2.723	1.522	0.276	0.426
HDT CL=2	0.302	0.256	1.440	0.805	0.103	0.159
HDT CL=3	0.252	0.211	1.249	0.698	0.142	0.219
HDT CL=4	0.504	0.685	2.659	2.427	0.363	0.914
TOTAL	5.321	3.533	34.609	13.680	4.388	4.713

YEAR 1975

-VEHICLE MILES IN BILLIONS-

	AUTO	LDT	HDT CLASS-2	HDT CLASS-3	HDT CLASS-4
URBAN	604.49	47.91	13.17	8.85	16.85
RURAL	494.55	71.77	19.91	15.57	40.76
TOTAL	1099.00	118.79	33.18	22.15	57.41

MILLION TONS/YEAR

	HC		CO		NOX	
	URBAN	RURAL	URBAN	RURAL	URBAN	RURAL
AUTO	3.385	1.696	23.744	7.242	3.208	2.698
LDT	0.354	0.338	2.355	1.479	0.366	0.410
HDT CL=2	0.279	0.235	1.352	0.756	0.099	0.153
HDT CL=3	0.333	0.192	1.172	0.655	0.136	0.210
HDT CL=4	0.466	0.623	2.497	2.279	0.349	0.878
TOTAL	4.719	3.084	31.322	12.363	4.059	4.351

YEAR 1976

-VEHICLE MILES IN BILLIONS-

	AUTO	LDT	HDT CLASS-2	HDT CLASS-3	HDT CLASS-4
URBAN	637.60	69.81	13.91	9.27	17.45
RURAL	513.30	74.73	20.87	13.91	42.74
TOTAL	1150.90	124.54	34.79	23.19	60.20

MILLION TONS/YEAR

	HC		CO		NOX	
	URBAN	RURAL	URBAN	RURAL	URBAN	RURAL
AUTO	2.978	1.457	21.184	6.356	2.939	2.432
LDT	0.525	0.305	3.382	1.352	0.254	0.392
HDT CL=2	0.255	0.209	1.261	0.705	0.095	0.147
HDT CL=3	0.213	0.172	1.093	0.611	0.130	0.201
HDT CL=4	0.428	0.559	2.328	2.124	0.336	0.841
TOTAL	4.199	2.706	28.247	11.151	3.755	4.016

YEAR 1977

-VEHICLE MILES IN BILLIONS-

	AUTO	LDT	HDT CLASS-2	HDT CLASS-3	HDT CLASS-4
URBAN	672.86	95.24	14.59	9.73	18.50
RURAL	533.98	78.36	21.89	14.59	44.82
TOTAL	1205.85	190.60	36.48	24.32	63.12

MILLION TONS/YEAR

	HC		CO		NOX	
	URBAN	RURAL	URBAN	RURAL	URBAN	RURAL
AUTO	2.990	1.233	18.854	9.567	2.690	2.190
LDT	0.294	0.273	2.207	1.234	0.243	0.375
HDT CL-2	0.232	0.186	1.168	0.653	0.091	0.140
HDT CL-3	0.193	0.153	1.013	0.566	0.124	0.192
HDT CL-4	0.986	0.497	2.157	1.968	0.319	0.803
TOTAL	3.698	2.345	25.401	9.991	3.469	3.702

YEAR 1978

-VEHICLE MILES IN BILLIONS-

	AUTO	LDT	HDT CLASS=2	HDT CLASS=3	HDT CLASS=4
URBAN	710.36	94.79	15.30	10.20	19.20
RURAL	553.62	42.18	22.96	15.30	47.01
TOTAL	1263.99	136.97	38.26	25.51	66.21

MILLION TONS/YEAR

	HC		CO		NOX	
	URBAN	RURAL	URBAN	RURAL	URBAN	RURAL
AUTO	2.264	1.042	17.159	4.985	2.477	1.984
LDT	0.264	0.241	2.033	1.137	0.231	0.356
HDT CL=2	0.208	0.164	1.076	0.601	0.086	0.135
HDT CL=3	0.174	0.134	0.933	0.521	0.118	0.183
HDT CL=4	0.347	0.437	1.986	1.818	0.303	0.764
TOTAL	3.260	2.020	23.189	9.059	3.218	3.422

YEAR 1979

-VEHICLE MILES IN BILLIONS-

	AUTO	LDT	HDT CLASS=2	HDT CLASS=3	HDT CLASS=4
URBAN	750.21	97.47	16.05	10.70	26.14
RURAL	575.25	66.21	24.08	16.05	49.31
TOTAL	1327.46	163.68	40.14	26.75	69.45

MILLION TONS/YEAR

	HC		CO		NOX	
	URBAN	RURAL	URBAN	RURAL	URBAN	RURAL
AUTO	1.974	0.676	15.890	4.542	2.259	1.780
LDT	0.240	0.217	1.861	1.041	0.219	0.338
HDT CL=2	0.130	0.149	0.985	0.551	0.082	0.126
HDT CL=3	0.159	0.122	0.854	0.477	0.112	0.173
HDT CL=4	0.317	0.398	1.819	1.660	0.288	0.724
TOTAL	2.882	1.764	21.411	8.272	2.961	3.143

YEAR 1980

-VEHICLE MILES IN BILLIONS-

	AUTO	LDT	HDT CLASS-2	HDT CLASS-3	HDT CLASS-4
URBAN	792.53	60.29	16.84	11.22	21.12
RURAL	597.88	90.43	25.26	16.84	51.78
TOTAL	1390.42	150.72	42.11	28.07	72.89

MILLION TONS/YEAR

	HC		CO		NOX	
	URBAN	RURAL	URBAN	RURAL	URBAN	RURAL
AUTO	1.685	0.718	14.195	3.092	2.056	1.994
LDT	0.215	0.193	1.695	0.948	0.207	0.919
HDT CL=2	0.172	0.134	0.897	0.501	0.077	0.119
HDT CL=3	0.144	0.111	0.777	0.433	0.106	0.163
HDT CL=4	0.288	0.360	1.656	1.011	0.271	0.684
TOTAL	2.506	1.518	19.223	7.985	2.719	3.881

YEAR 1981

-VEHICLE MILES IN BILLIONS-

	AUTO	LDT	HDT CLASS-2	HDT CLASS-3	HDT CLASS-4
URBAN	837.46	69.84	17.67	11.78	22.16
RURAL	621.53	94.87	26.50	17.67	54.26
TOTAL	1459.00	158.12	44.17	29.45	76.43

MILLION TONS/YEAR

	HC		CO		NOX	
	URBAN	RURAL	URBAN	RURAL	URBAN	RURAL
AUTO	1.962	0.611	13.925	3.852	1.851	1.411
LDT	0.191	0.170	1.336	0.859	0.194	0.300
HDT CL-2	0.155	0.120	0.813	0.454	0.072	0.112
HDT CL-3	0.130	0.099	0.705	0.394	0.099	0.154
HDT CL-4	0.359	0.322	1.901	1.369	0.255	0.643
TOTAL	2.839	1.323	18.481	6.931	2.474	2.622

YEAR 1982

-VEHICLE MILES IN BILLIONS-

	AUTO	LDT	HDT CLASS-2	HDT CLASS-3	HDT CLASS-4
URBAN	885.12	66.35	18.52	12.39	23.25
RURAL	646.23	99.52	27.80	18.53	36.92
TOTAL	1531.35	165.87	46.34	30.89	60.17

MILLION TONS/YEAR

	HC		CO		NOX	
	URBAN	RURAL	URBAN	RURAL	URBAN	RURAL
AUTO	1.328	0.518	13.566	3.695	1.662	1.247
LDT	0.168	0.147	1.388	0.776	0.182	0.281
HDT CL-2	0.138	0.106	0.734	0.410	0.068	0.105
HDT CL-3	0.116	0.088	0.636	0.356	0.093	0.144
HDT CL-4	0.231	0.286	1.359	1.237	0.239	0.602
TOTAL	1.984	1.146	17.681	6.472	2.244	2.380

YEAR 1983

=VEHICLE MILES IN BILLIONS=

	AUTO	LDT	HDT CLASS=2	HDT CLASS=3	HDT CLASS=4
URBAN	939.69	69.60	19.44	12.96	24.39
RURAL	671.98	104.40	29.16	19.44	59.71
TOTAL	1607.61	174.00	48.61	32.40	84.10

MILLION TONS/YEAR

	HC		CO		NOX	
	URBAN	RURAL	URBAN	RURAL	URBAN	RURAL
AUTO	1.191	0.431	13.664	3.658	1.507	1.112
LDT	0.146	0.125	1.252	0.700	0.170	0.262
HDT CL=2	0.122	0.093	0.662	0.370	0.068	0.098
HDT CL=3	0.102	0.077	0.574	0.321	0.087	0.134
HDT CL=4	0.205	0.252	1.229	1.116	0.223	0.561
TOTAL	1.769	0.982	17.377	6.167	2.051	2.169

YEAR 1984

=VEHICLE MILES IN BILLIONS=

	AUTO	LDT	HDT CLASS=2	HDT CLASS=3	HDT CLASS=4
URBAN	989.13	73.00	20.39	13.89	25.58
RURAL	698.80	109.50	30.59	20.39	62.63
TOTAL	1687.94	182.51	50.99	33.99	88.22

MILLION TONS/YEAR

	HC		CO		NOX	
	URBAN	RURAL	URBAN	RURAL	URBAN	RURAL
AUTO	1.131	0.397	13.855	3.649	1.376	0.999
LDT	0.131	0.109	1.226	0.685	0.157	0.243
HDT CL=2	0.112	0.084	0.648	0.362	0.059	0.091
HDT CL=3	0.094	0.070	0.562	0.314	0.081	0.124
HDT CL=4	0.189	0.230	1.197	1.093	0.207	0.321
TOTAL	1.659	0.893	17.489	6.104	1.882	1.980

YEAR 1985

=VEHICLE MILES IN BILLIONS=

	AUTO	LDT	HDT CLASS=2	HDT CLASS=3	HDT CLASS=4
URBAN	1045.76	76.56	21.39	14.26	26.83
RURAL	726.71	114.84	32.08	21.39	65.69
TOTAL	1772.47	191.41	53.47	35.65	92.52

MILLION TONS/YEAR

	HC		CO		NOX	
	URBAN	RURAL	URBAN	RURAL	URBAN	RURAL
AUTO	1.107	0.377	14.238	3.688	1.305	0.932
LDT	0.116	0.093	1.204	0.673	0.146	0.225
HDT CL=2	0.103	0.076	0.637	0.356	0.054	0.084
HDT CL=3	0.087	0.064	0.552	0.308	0.076	0.115
HDT CL=4	0.174	0.210	1.176	1.073	0.191	0.482
TOTAL	1.589	0.822	17.808	6.100	1.772	1.840

YEAR 1984

-VEHICLE MILES IN BILLIONS-

	AUTO	LDT	HDT CLASS-2	HDT CLASS-3	HDT CLASS-4
URBAN	1105.64	80.29	32.45	14.95	26.13
RURAL	755.71	120.43	33.64	22.43	66.81
TOTAL	1861.35	200.72	66.07	37.38	97.02

MILLION TONS/YEAR

	HC		CO		NOX	
	URBAN	RURAL	URBAN	RURAL	URBAN	RURAL
AUTO	1.112	0.870	14.706	5.767	1.281	0.900
LDT	0.106	0.080	1.212	0.678	0.134	0.207
HDT CL=2	0.097	0.071	0.641	0.358	0.080	0.077
HDT CL=3	0.083	0.060	0.556	0.311	0.069	0.106
HDT CL=4	0.164	0.197	1.184	1.080	0.176	0.445
TOTAL	1.565	0.780	18.380	8.196	1.719	1.736

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YEAR 1987

-VEHICLE MILES IN BILLIONS-

	AUTO	LDT	HDT CLASS-2	HDT CLASS-3	HDT CLASS-4
URBAN	1168.92	84.17	23.81	15.87	29.50
RURAL	785.80	156.26	35.27	23.51	72.28
TOTAL	1954.72	240.44	59.79	39.19	101.78

MILLION TONS/YEAR

	HC		CO		NOX	
	URBAN	RURAL	URBAN	RURAL	URBAN	RURAL
AUTO	1.078	0.747	15.180	3.804	1.189	0.821
LDT	0.101	0.076	1.224	0.604	0.124	0.191
HDT CL-2	0.093	0.068	0.647	0.362	0.046	0.071
HDT CL-3	0.079	0.057	0.561	0.314	0.063	0.098
HDT CL-4	0.159	0.189	1.195	1.091	0.163	0.410
TOTAL	1.513	0.736	18.810	6.256	1.587	1.593

YEAR 1988

=VEHICLE MILES IN BILLIONS=

	AUTO	LDT	HDT CLASS=2	HDT CLASS=3	HDT CLASS=4
URBAN	1235.74	88.84	39.65	16.43	30.92
RURAL	816.99	132.36	36.97	24.65	75.70
TOTAL	2052.73	220.60	61.63	41.08	106.63

MILLION TONS/YEAR

	HC		CO		NOX	
	URBAN	RURAL	URBAN	RURAL	URBAN	RURAL
AUTO	1.139	0.360	16.048	5.955	1.257	0.854
LDT	0.097	0.071	1.240	0.693	0.114	0.178
HDT CL=2	0.090	0.065	0.856	0.366	0.082	0.066
HDT CL=3	0.077	0.050	0.968	0.318	0.068	0.090
HDT CL=4	0.184	0.182	1.811	1.109	0.150	0.378
TOTAL	1.589	0.736	19.725	8.439	1.624	1.966

YEAR 1989

-VEHICLE MILES IN BILLIONS-

	AUTO	LDT	HDT CLASS-2	HDT CLASS-3	HDT CLASS-4
URBAN	1906.25	92.47	25.83	17.22	32.40
RURAL	849.28	138.71	38.75	25.83	79.34
TOTAL	2155.53	231.19	64.59	43.06	111.75

MILLION TONS/YEAR

	HC		CO		NOX	
	URBAN	RURAL	URBAN	RURAL	URBAN	RURAL
AUTO	1.204	0.375	16.964	4.111	1.329	0.888
LDT	0.093	0.068	1.261	0.705	0.105	0.163
HDT CL=2	0.088	0.063	0.867	0.373	0.039	0.061
HDT CL=3	0.075	0.054	0.578	0.323	0.054	0.083
HDT CL=4	0.150	0.176	1.231	1.124	0.138	0.349
TOTAL	1.611	0.737	20.705	6.637	1.668	1.946

YEAR 1990

-VEHICLE MILES IN BILLIONS-

	AUTO	LDT	HDT CLASS-2	HDT CLASS-3	HDT CLASS-4
URBAN	1980.58	96.89	27.06	18.04	39.95
RURAL	982.67	149.33	40.60	27.06	89.13
TOTAL	2263.26	242.23	67.67	45.11	117.08

MILLION TONS/YEAR

	HC		CO		NOX	
	URBAN	RURAL	URBAN	RURAL	URBAN	RURAL
AUTO	1.212	0.389	17.929	4.273	1.405	0.921
LDT	0.090	0.064	1.288	0.720	0.098	0.152
HDT CL-2	0.086	0.061	0.681	0.380	0.096	0.056
HDT CL-3	0.073	0.052	0.590	0.330	0.080	0.078
HDT CL-4	0.147	0.172	1.257	1.147	0.129	0.325
TOTAL	1.670	0.742	21.746	6.852	1.720	1.535

YEAR 1975

(WITHOUT ADDITIONAL CONTROLS IN 1975)

-VEHICLE MILES IN BILLIONS-

	AUTO	LDT	HDT CLASS-2	HDT CLASS-3	HDT CLASS-4
URBAN	604.49	47.91	13.27	8.85	16.65
RURAL	494.55	71.27	19.91	13.27	40.76
TOTAL	1099.00	118.79	33.18	22.12	57.41

MILLION TONS/YEAR

	HC		CO		NOX	
	URBAN	RURAL	URBAN	RURAL	URBAN	RURAL
AUTO	3.643	1.819	24.824	7.871	3.698	3.105
LDT	0.568	0.350	2.610	1.459	0.290	0.447
HDT CL-2	0.290	0.241	1.381	0.772	0.108	0.167
HDT CL-3	0.242	0.198	1.197	0.669	0.143	0.229
HDT CL-4	0.483	0.645	2.549	2.327	0.380	0.958
TOTAL	5.028	3.255	32.563	13.801	4.621	4.908

[illegible]

YEAR 1976

(WITHOUT ADDITIONAL CONTROLS IN 1975)

-VEHICLE MILES IN BILLIONS-

	AUTO	LDT	HDT CLASS-2	HDT CLASS-3	HDT CLASS-4
URBAN	637.60	49.61	13.91	9.27	17.45
RURAL	513.30	74.72	20.87	13.91	42.74
TOTAL	1150.90	124.34	34.79	23.19	60.20

MILLION TONS/YEAR

	HC		CO		NOX	
	URBAN	RURAL	URBAN	RURAL	URBAN	RURAL
AUTO	3.503	1.702	23.406	7.024	3.695	3.223
LDT	0.352	0.329	2.499	1.397	0.304	0.469
HDT CL-2	0.278	0.227	1.522	0.759	0.113	0.175
HDT CL-3	0.232	0.186	1.146	0.641	0.156	0.240
HDT CL-4	0.464	0.606	2.441	2.228	0.399	1.005
TOTAL	4.830	3.050	30.814	12.051	4.869	5.113

YEAR 1977

(WITHOUT ADDITIONAL CONTROLS IN 1975)

=VEHICLE MILES IN BILLIONS=

	AUTO	LDT	HDT CLASS-2	HDT CLASS-3	HDT CLASS-4
URBAN	672.86	52.24	14.59	9.73	18.30
RURAL	532.98	78.36	21.89	14.59	44.82
TOTAL	1205.85	130.60	36.48	24.32	63.12

MILLION TONS/YEAR

	HC		CO		NOX	
	URBAN	RURAL	URBAN	RURAL	URBAN	RURAL
AUTO	3.384	1.596	22.247	6.569	4.110	3.346
LDT	0.337	0.310	2.390	1.336	0.319	0.492
HDT CL=2	0.267	0.213	1.365	0.707	0.119	0.184
HDT CL=3	0.223	0.179	1.096	0.618	0.169	0.252
HDT CL=4	0.445	0.570	2.339	2.131	0.418	1.056
TOTAL	4.656	2.867	29.336	11.359	5.132	5.329

YEAR 1978

(WITHOUT ADDITIONAL CONTROLS IN 1975)

-VEHICLE MILES IN BILLIONS-

	AUTO	LDT	HDT CLASS-2	HDT CLASS-3	HDT CLASS-4
URBAN	710.36	54.79	15.30	10.20	19.20
RURAL	553.62	82.18	21.96	15.30	47.01
TOTAL	1263.99	136.97	38.26	25.51	66.21

MILLION TONS/YEAR

	HC		CO		NOX	
	URBAN	RURAL	URBAN	RURAL	URBAN	RURAL
AUTO	3.814	1.915	21.682	6.299	4.339	3.476
LDT	0.523	0.292	3.287	1.278	0.334	0.516
HDT CL=2	0.257	0.251	1.210	0.676	0.125	0.193
HDT CL=3	0.219	0.165	1.049	0.586	0.171	0.264
HDT CL=4	0.489	0.537	2.253	2.038	0.439	1.105
TOTAL	4.959	2.711	29.463	10.880	5.411	5.555

YEAR 1979

(WITHOUT ADDITIONAL CONTROLS IN 1975)

-VEHICLE MILES IN BILLIONS-

	AUTO	LDT	HDT CLASS-2	HDT CLASS-3	HDT CLASS-4
URBAN	750.21	97.47	16.05	10.70	20.14
RURAL	575.25	86.21	24.08	16.05	49.31
TOTAL	1325.46	143.68	40.14	26.76	69.45

MILLION TONS/YEAR

	HC		CO		NOX	
	URBAN	RURAL	URBAN	RURAL	URBAN	RURAL
AUTO	3.294	1.459	21.606	6.176	4.583	3.612
LDT	0.315	0.282	2.189	1.224	0.351	0.541
HDT CL-2	0.259	0.197	1.158	0.647	0.131	0.202
HDT CL-3	0.211	0.162	1.004	0.561	0.180	0.277
HDT CL-4	0.422	0.327	2.138	1.951	0.460	1.159
TOTAL	4.497	2.628	28.047	10.561	5.706	5.793

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YEAR 1980

(WITHOUT ADDITIONAL CONTROLS IN 1975)

-VEHICLE MILES IN BILLIONS-

	AUTO	LDT	HDT CLASS-2	HDT CLASS-3	HDT CLASS-4
URBAN	792.93	60.29	16.84	11.22	21.12
RURAL	597.88	90.43	25.26	16.84	51.72
TOTAL	1390.43	150.72	42.11	28.07	72.85

MILLION TONS/YEAR

	HC		CO		NOX	
	URBAN	RURAL	URBAN	RURAL	URBAN	RURAL
AUTO	3.274	1.408	21.109	5.936	4.842	3.754
LDT	0.308	0.273	2.100	1.174	0.368	0.567
HDT CL-2	0.249	0.193	1.111	0.621	0.197	0.213
HDT CL-3	0.209	0.159	0.963	0.538	0.189	0.291
HDT CL-4	0.417	0.518	2.051	1.872	0.483	1.216
TOTAL	4.458	2.554	27.333	10.143	6.020	6.042

YEAR 1981

(WITHOUT ADDITIONAL CONTROLS IN 1975)

-VEHICLE MILES IN BILLIONS-

	AUTO	LDT	HDT CLASS-2	HDT CLASS-3	CLASS-4
URBAN	837.46	69.24	17.67	11.78	22.16
RURAL	621.53	94.87	26.50	17.67	54.26
TOTAL	1459.00	158.12	44.17	29.45	76.43

MILLION TONS/YEAR

	HC		CO		NOX	
	URBAN	RURAL	URBAN	RURAL	URBAN	RURAL
AUTO	3.973	1.410	22.092	8.112	3.116	3.902
LDT	0.902	0.265	2.022	1.130	0.386	0.978
HDT CL=2	0.246	0.190	1.069	0.898	0.144	0.225
HDT CL=3	0.207	0.157	0.927	0.518	0.198	0.305
HDT CL=4	0.413	0.512	1.974	1.801	0.507	1.276
TOTAL	4.942	2.534	28.084	10.161	6.352	6.304

YEAR 1982

(WITHOUT ADDITIONAL CONTROLS IN 1975)

-VEHICLE MILES IN BILLIONS-

	AUTO	LDT	HDT CLASS-2	HDT CLASS-3	HDT CLASS-4
URBAN	885.12	66.35	18.53	12.35	23.23
RURAL	646.23	99.52	27.80	18.53	36.92
TOTAL	1531.35	165.87	46.34	30.89	60.17

MILLION TONS/YEAR

	HC		CO		NOX	
	URBAN	RURAL	URBAN	RURAL	URBAN	RURAL
AUTO	3.479	1.421	22.989	6.157	5.407	4.057
LDT	0.297	0.258	1.956	1.094	0.408	0.624
HDT CL-2	0.245	0.188	1.034	0.578	0.151	0.233
HDT CL-3	0.205	0.156	0.897	0.501	0.208	0.320
HDT CL-4	0.413	0.507	1.910	1.748	0.532	1.338
TOTAL	4.639	2.533	28.788	10.178	6.704	6.576

YEAR 1983

(WITHOUT ADDITIONAL CONTROLS IN 1975)

-VEHICLE MILES IN BILLIONS-

	AUTO	LDT	HDT CLASS-2	HDT CLASS-3	HDT CLASS-4
URBAN	935.63	69.60	19.44	12.96	24.39
RURAL	471.98	104.40	29.16	19.44	59.71
TOTAL	1407.61	174.00	48.61	32.40	84.10

MILLION TONS/YEAR

	HC		CO		NOX	
	URBAN	RURAL	URBAN	RURAL	URBAN	RURAL
AUTO	3.612	1.431	24.301	6.506	5.716	4.219
LDT	0.294	0.259	1.907	1.066	0.425	0.655
HDT CL-2	0.244	0.187	1.308	0.563	0.159	0.245
HDT CL-3	0.206	0.155	0.874	0.458	0.218	0.336
HDT CL-4	0.411	0.906	1.861	1.698	0.558	1.404
TOTAL	4.769	2.934	29.952	10.324	7.076	6.861

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YEAR 1984

(WITHOUT ADDITIONAL CONTROLS IN 1975)

-VEHICLE MILES IN BILLIONS-

	AUTO	LDT	HDT CLASS-2	HDT CLASS-3	HDT CLASS-4
URBAN	989.13	73.00	20.39	13.89	25.58
RURAL	698.80	109.50	30.59	20.39	42.63
TOTAL	1687.94	182.51	50.99	33.99	68.22

MILLION TONS / YEAR

	HC		CO		NOX	
	URBAN	RURAL	URBAN	RURAL	URBAN	RURAL
AUTO	3.819	1.488	25.691	6.766	6.043	4.387
LDT	0.298	0.253	1.968	1.100	0.446	0.687
HDT CL-2	0.251	0.191	1.040	0.581	0.166	0.257
HDT CL-3	0.211	0.159	0.902	0.504	0.228	0.352
HDT CL-4	0.422	0.517	1.920	1.793	0.589	1.472
TOTAL	5.002	2.609	31.523	10.706	7.470	7.158

YEAR 1985

(WITHOUT ADDITIONAL CONTROLS IN 1975)

-VEHICLE MILES IN BILLIONS-

	AUTO	LDT	HDT CLASS-2	HDT CLASS-3	HDT CLASS-4
URBAN	1045.78	76.96	23.39	14.26	26.87
RURAL	726.71	114.84	32.08	21.39	65.69
TOTAL	1772.47	191.41	55.47	35.65	92.52

MILLION TONS/YEAR

	HC		CO		NOX	
	URBAN	RURAL	URBAN	RURAL	URBAN	RURAL
AUTO	4.097	1.548	27.162	7.056	6.389	4.563
LDT	0.903	0.254	2.036	1.138	0.467	0.721
HDT CL=2	0.258	0.195	1.076	0.602	0.178	0.269
HDT CL=3	0.217	0.163	0.933	0.521	0.240	0.370
HDT CL=4	0.439	0.530	1.987	1.813	0.613	1.544
TOTAL	5.252	2.691	33.195	11.112	7.885	7.469

YEAR 1986

(WITHOUT ADDITIONAL CONTROLS IN 1975)

-VEHICLE MILES IN BILLIONS-

	AUTO	LDT	HDT CLASS-2	HDT CLASS-3	HDT CLASS-4
URBAN	1109.64	80.28	22.43	14.95	28.13
RURAL	755.71	120.43	33.64	22.43	68.88
TOTAL	1861.35	200.72	56.07	37.38	97.02

MILLION TONS/YEAR

	HC		CO		NOX	
	URBAN	RURAL	URBAN	RURAL	URBAN	RURAL
AUTO	4.269	1.609	28.717	7.917	6.754	4.745
LDT	0.919	0.258	2.139	1.193	0.490	0.756
HDT CL-2	0.269	0.203	1.128	0.631	0.159	0.283
HDT CL-3	0.227	0.169	0.978	0.547	0.291	0.388
HDT CL-4	0.454	0.532	2.083	1.901	0.643	1.619
TOTAL	5.933	2.795	35.044	11.891	8.724	7.792

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YEAR 1987

(WITHOUT ADDITIONAL CONTROLS IN 1975)

-VEHICLE MILES IN BILLIONS-

	AUTO	LDT	HDT CLASS-2	HDT CLASS-3	HDT CLASS-4
URBAN	1168.92	84.17	23.51	15.67	29.90
RURAL	785.80	126.26	35.27	23.51	72.28
TOTAL	1954.72	210.44	58.79	39.18	101.78

MILLION TONS/YEAR

	HC		CO		NOX	
	URBAN	RURAL	URBAN	RURAL	URBAN	RURAL
AUTO	4.513	1.674	30.361	7.608	7.141	4.934
LDT	0.928	0.271	2.238	1.251	0.914	0.792
HDT CL=2	0.282	0.712	1.183	0.661	0.192	0.296
HDT CL=3	0.238	0.577	1.026	0.573	0.265	0.406
HDT CL=4	0.476	0.579	2.184	1.994	0.674	1.698
TOTAL	6.839	3.913	36.994	12.090	8.787	8.129

YEAR 1985

(WITHOUT ADDITIONAL CONTROLS IN 1975)

-VEHICLE MILES IN BILLIONS-

	AUTO	LDT	HDT CLASS-2	HDT CLASS-3	HDT CLASS-4
URBAN	1235.74	88.24	24.65	16.43	30.92
RURAL	816.99	132.36	36.97	24.65	75.70
TOTAL	2052.73	220.60	61.63	41.08	106.63

MILLION TONS/YEAR

	HC		CO		NOX	
	URBAN	RURAL	URBAN	RURAL	URBAN	RURAL
AUTO	4.771	3.740	32.096	7.910	7.549	5.130
LDT	0.344	0.284	2.346	1.312	0.5[illegible]	0.691
HDT CL-2	0.296	0.223	1.240	0.693	0.201	0.311
HDT CL-3	0.249	0.186	1.075	0.601	0.276	0.426
HDT CL-4	0.499	0.606	3.790	3.090	0.707	1.780
TOTAL	6.161	5.041	39.049	12.608	9.274	8.479

YEAR 1969

(WITHOUT ADDITIONAL CONTROLS IN 1975)

-VEHICLE MILES IN BILLIONS-

	AUTO	LDT	HDT CLASS-2	HDT CLASS-3	HDT CLASS-4
URBAN	1304.25	92.47	25.83	17.22	32.40
RURAL	849.28	138.71	38.75	25.83	79.34
TOTAL	2153.53	231.19	64.59	43.06	111.75

MILLION TONS / YEAR

	HC		CO		NOX	
	URBAN	RURAL	URBAN	RURAL	URBAN	RURAL
AUTO	5.043	1.809	33.928	8.223	7.980	3.332
LDT	0.360	0.298	4.459	1.875	0.964	0.871
HDT CL=2	0.310	0.233	1.301	0.727	0.211	0.326
HDT CL=3	0.261	0.195	1.127	0.630	0.289	0.446
HDT CL=4	0.523	0.636	2.400	2.190	0.741	1.865
TOTAL	6.500	3.172	43.215	13.146	9.788	8.842

YEAR 1990

(WITHOUT ADDITIONAL CONTROLS IN 1975)

-VEHICLE MILES IN BILLIONS-

	AUTO	LDT	HDT CLASS-2	HDT CLASS-3	HDT CLASS-4
URBAN	1380.58	96.59	27.06	18.04	33.95
RURAL	882.67	145.33	40.60	27.06	83.19
TOTAL	2263.26	241.93	67.67	45.11	117.08

MILLION TONS/YEAR

	HC		CO		NOX	
	URBAN	RURAL	URBAN	RURAL	URBAN	RURAL
AUTO	5.330	1.080	33.858	8.546	8.434	5.542
LDT	0.578	0.312	2.978	1.440	0.991	0.912
HDT CL-2	0.325	0.244	1.362	0.761	0.221	0.341
HDT CL-3	0.274	0.204	1.181	0.660	0.303	0.468
HDT CL-4	0.948	0.666	2.514	2.295	0.776	1.954
TOTAL	6.856	3.309	43.493	13.705	10.728	9.219